ABB - Power-One

String Inverters

13-14.02.2014

Budapest, HU

Attila Balogh, Jozef Krajcovic

Programme

Company presentation

Product overview and technical data

Topology and functions

Installation

Commisioning and operation

Communication and monitoring

Correct sizing with Aurora Designer or Stringsizer

power-one®
A MEMBER OF THE ABB GROUP

Power-One Company Presentation

Employees: 1900 (RE) – 3300 (Total)

2012 Revenue: $1.023 B

Delivered inverters worldwide:
more than 1 mill. units

≈ 11 GW, equal 5 nuclear power plants

Confidential

Global Manufacturing Facilities

Confidential

Manufacturing Plants

Increased production capacity

ITALY

- Terranuova Bracciolini, Arezzo
- Production capacity: 4GW

4GW

US

- Phoenix, Arizona
- Production capacity: 1GW by the end of 2011

CANADA

- Toronto, Ontario
- Production capacity: 0,5GW by the end of 2011

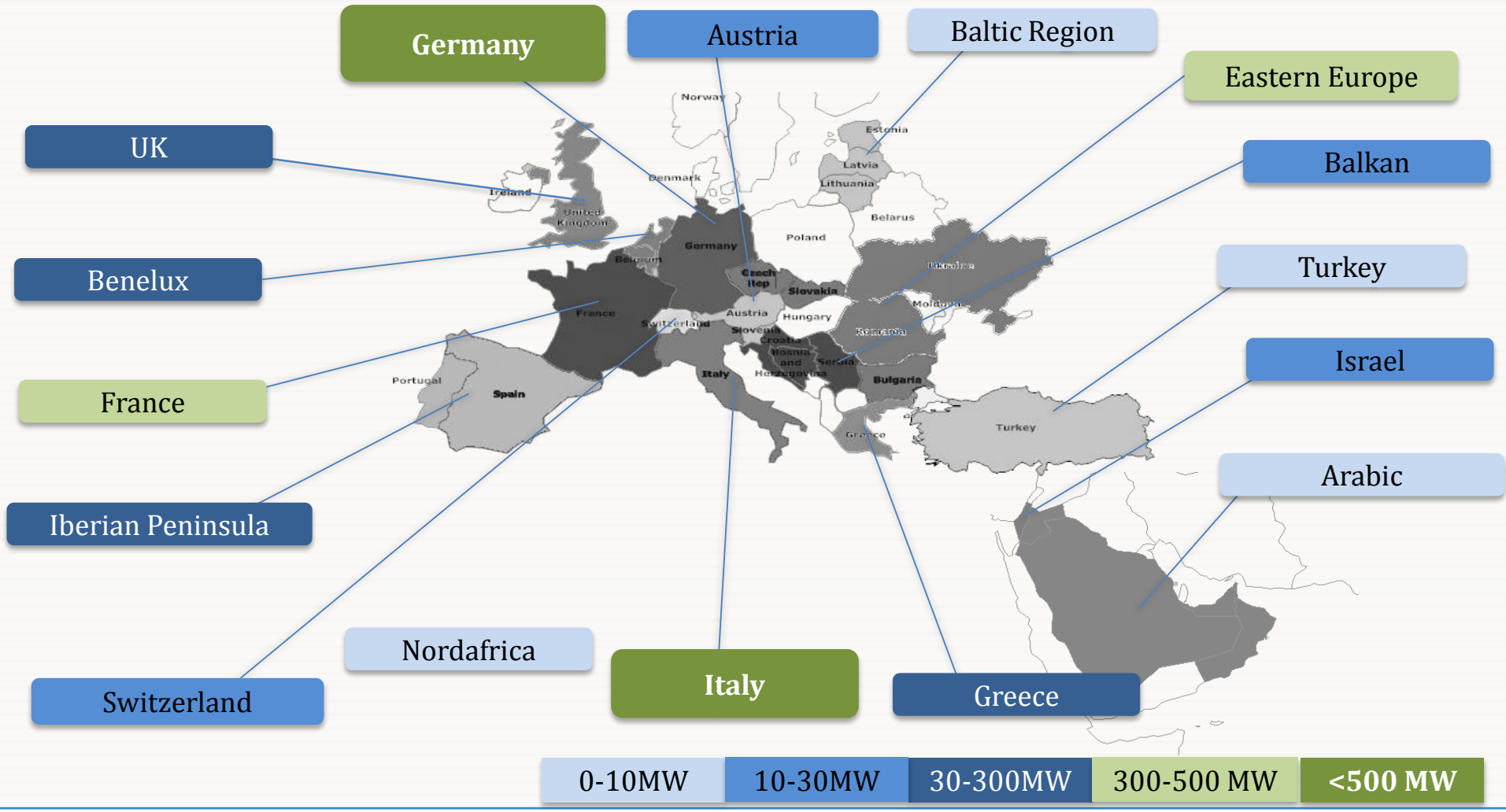
CHINA

- Shenzhen
- Production capacity: 1GW by the end of 2011

over 6GW

Confidential

Power-One's Installed Base – EMEA ~ 9GW



Confidential

power-one® A MEMBER OF THE ABB GROUP

ABB and Power-One

- Power-One has been acquired by ABB
- ABB leading provider of power and automation technology with 145,000 employees in around 100 countries
- Advantages of transaction
  - Strong brand - increase the level of awareness
  - Broadening of the PV inverter portfolio
  - Increase customer satisfaction through global service infrastructure
  - Expansion of its global presence for a quick entry into new markets

Confidential

Program

Company presentation

Product overview and technical data

Topology and functions

Installation

Commisioning and operation

Communication and monitoring

Correct sizing with Aurora Designer or Stringsizer

Renewable Energy / PV Product Offering

Residential

MICRO-0.25-I
MICRO-0.3-I

UNO-2.0-I-OUTD
UNO-2.5-I-OUTD

PVI-3.0-OUTD
PVI-3.6-OUTD
PVI-4.2-OUTD

PVI-3.8-I-OUTD
PVI-4.6-I-OUTD

PVI-6000-OUTD

TRIO-5.8-TL
TRIO-7.5-TL
TRIO-8.5-TL

New

0kW | 1kW | 2kW | 3kW | 4kW | 5kW | 6kW | 7kW | 8kW

Commercial

10 years

PVI -10.0-I-OUTD
PVI-12.0-I-OUTD

10 years

PVI-12.5-OUTD-TL
PVI-10.0-OUTD-TL
PVI-8.0-OUTD-TL
PVI-6.0-OUTD-TL

10 years

TRIO-27.6-TL
TRIO-20.0-TL

PVI-400.0-TL/I
PVI-165.0-TL/I
PVI-330.0-TL/I
PVI-110.0-TL/I
PVI-275.0-TL/I
PVI-55.0-TL/I
PVI-220.0-TL/I

10kW | 20kW | 30kW | 40kW | 50kW | 100kW | 150kW | 200kW | 300kW | 400 kW

Utility

PVI-400.0-TL/I
PVI-275.0-TL/I
PVI-330.0-TL/I
PVI-220.0-TL/I

PVI-STATION-1320/1100-XX-DE
PVI-STATION-770/1000-XX-DE
PVI-STATION-700/440-XX-DE

ULTRA 700.0 TL
ULTRA 1050.0 TL
ULTRA 1400.0 TL

PVI-STATION-1320/1100-XX-IT
PVI-STATION-770/1000-XX-IT
PVI-STATION-700/440-XX-IT

ULTRA-STATION-1500-IT
ULTRA-STATION-2200-IT
ULTRA-STATION-3000-IT

200 kW | 300 kW | 400 kW | 500 kW | 600 kW | 700 kW | 800 kW | 900 kW | 1MW | 1.5 MW | 2.0 MW | 2.5 MW | 3MW

Confidential

power-one® A MEMBER OF THE ABB GROUP

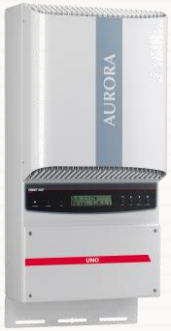
Renewable Energy / PV Product Offering

Residential

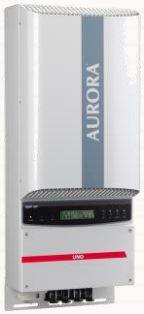
MICRO-0.25-I
MICRO-0.3-I

UNO-2.0-I-OUTD
UNO-2.5-I-OUTD

PVI-3.0-OUTD
PVI-3.6-OUTD
PVI-4.2-OUTD



PVI-3.8-I-OUTD
PVI-4.6-I-OUTD



PVI-6000-OUTD

New

TRIO-5.8-TL
TRIO-7.5-TL
TRIO-8.5-TL

0kW	1kW	2kW	3kW	4kW	5kW	6kW	7kW	8kW

Confidential

power-one® A MEMBER OF THE ABB GROUP

Renewable Energy / PV Product Offering

Commercial

10 years

PVI -10.0-I-OUTD
PVI-12.0-I-OUTD

10 years

PVI-12.5-OUTD-TL
PVI-10.0-OUTD-TL
PVI-8.0-OUTD-TL
PVI-6.0-OUTD-TL

10 years

TRIO-27.6-TL
TRIO-20.0-TL

PVI-400.0-TL/I
PVI-165.0-TL/I

PVI-330.0-TL/I
PVI-110.0-TL/I

PVI-275.0-TL/I
PVI-55.0-TL/I

PVI-220.0-TL/I

10kW	20kW	30kW	40kW	50kW	100kW	150kW	200kW	300kW	400 kW

Confidential

power-one® A MEMBER OF THE ABB GROUP

Renewable Energy / PV Product Offering

Utility

PVI-400.0-TL/I PVI-330.0-TL/I
PVI-275.0-TL/I PVI-220.0-TL/I

ULTRA 700.0 TL
ULTRA 1050.0 TL
ULTRA 1400.0 TL

PVI-STATION-1320/1100-XX-DE
PVI-STATION-770/1000-XX-DE
PVI-STATION-700/440-XX-DE

PVI-STATION-1320/1100-XX-IT
PVI-STATION-770/1000-XX-IT
PVI-STATION-700/440-XX-IT

ULTRA-STATION-1500-IT
ULTRA-STATION-2200-IT
ULTRA-STATION-3000-IT

200 kW	300 kW	400 kW	500 kW	600 kW	700 kW	800 kW	900 kW	1 MW	1.5 MW	2.0 MW	2.5 MW	3 MW

Confidential

power-one® A MEMBER OF THE ABB GROUP

String / Central Inverter Monitoring – Aurora Logger

Certified Inverters

- **RWE / EDF minősített inverterek**
- UNO-2.0-I-OUTD
- UNO-2.0-I-OUTD-S
- UNO-2.5-I-OUTD
- UNO-2.5-I-OUTD-S
- PVI-6.0-TL-OUTD
- PVI-6.0-TL-OUTD-S
- PVI-6.0-TL-OUTD-FS
- PVI-8.0-TL-OUTD
- PVI-8.0-TL-OUTD-S
- PVI-8.0-TL-OUTD-FS
- TRIO-5.8-TL-OUTD
- TRIO-7.5-TL-OUTD
- TRIO-8.5-TL-OUTD
- TRIO-20.0-TL-OUTD-400
- TRIO-20.0-TL-OUTD-S2-400
- TRIO-20.0-TL-OUTD-S2X-400
- TRIO-20.0-TL-OUTD-S2F-400
- TRIO-20.0-TL-OUTD-S1J-400
- TRIO-20.0-TL-OUTD-S2J-400
- TRIO-27.6-TL-OUTD-400
- TRIO-27.6-TL-OUTD-S2-400
- TRIO-27.6-TL-OUTD-S2X-400
- TRIO-27.6-TL-OUTD-S2F-400
- TRIO-27.6-TL-OUTD-S1J-400
- TRIO-27.6-TL-OUTD-S2J-400

- **E.ON Minősített inverterek listája**
- Uno-2.0-I-OUTD 2 kVA 1F
- Uno-2.5-I-OUTD 2,5 kVA 1F
- PVI-3.0-TL-OUTD 3 kVA 1F
- PVI-3.6-TL-OUTD 3,6 kVA 1F
- PVI-4.2-TL-OUTD 4,2 kVA 1F
- PVI-5000-TL-OUTD 5 kVA 3F
- PVI-6000-TL-OUTD 6 kVA 3F
- PVI-6.0-TL-OUTD 6 kVA 3F
- PVI-8.0-TL-OUTD 8 kVA 3F
- PVI-10.0-TL-OUTD 10 kVA 3F
- PVI-10.0-I-OUTD 10 kVA 3F
- PVI-12.5-TL-OUTD 12,5 kVA 3F
- PVI-12.5-I-OUTD 12,5 kVA 3F
- Trio-5.8-TL-OUTD
- Trio-7.5-TL-OUTD
- Trio-8.5-TL-OUTD
- Trio-20.0-TL-OUTD 20 kVA 3F
- Trio-27.6-TL-OUTD 27,6 kVA 3F

Confidential

Technical details

AURORA MICRO – module inverter

AURORA UNO-2.0/2.5-I-OUTD - 1-phase-string-inverter

Other 1-phase string-inverter

PVI-6.0/8.0/10.0/12.5-TL-OUTD
3-phase-string-inverter

TRIO - 5.8/7.5/8.5 kW-TL-OUTD
3-phase-string-inverter

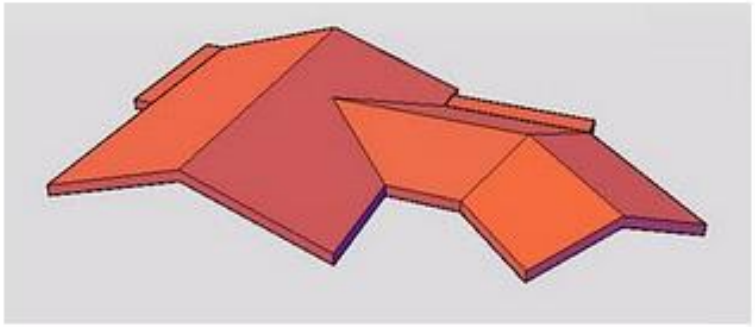
TRIO-27.6-TL-OUTD & TRIO-20.0-TL-OUTD
3-phase-string-inverter

Why Use MICRO?

High energy harvesting	• High efficiency • MPP tracking at module level
High reliability	• Natural convection cooling • Electrolyte free • No «single point of failure»
Fast installation	• No costly DC cabling • «Plug&Play» AC wiring • Quick design
Easy to use	• Wireless communication • Integrated Web-Server (CDD) • Integration into the DSL home network
Flexible PV plant planning	• Wide input voltage range • Compatible with almost any type of PV module • Realization of small systems

Confidential

Micro Installation Advantages

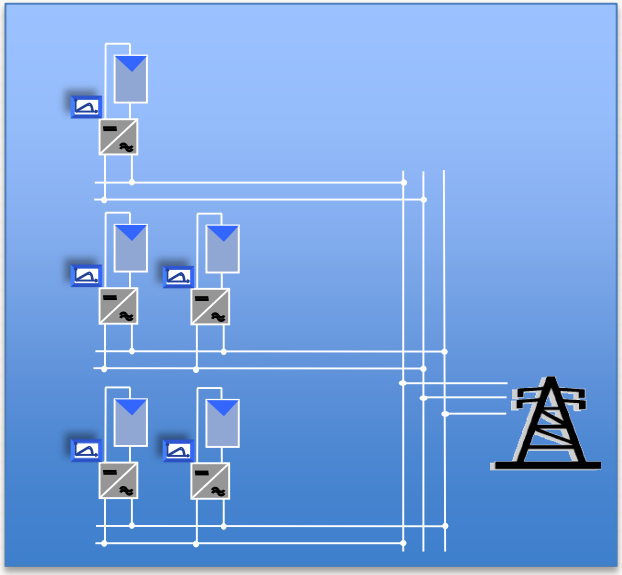


Installation flexibility

Suitable for complex application
(different orientation, tilt and azimuth)

Maximum expansion

Module indipendence and replacement flexibility



Confidential

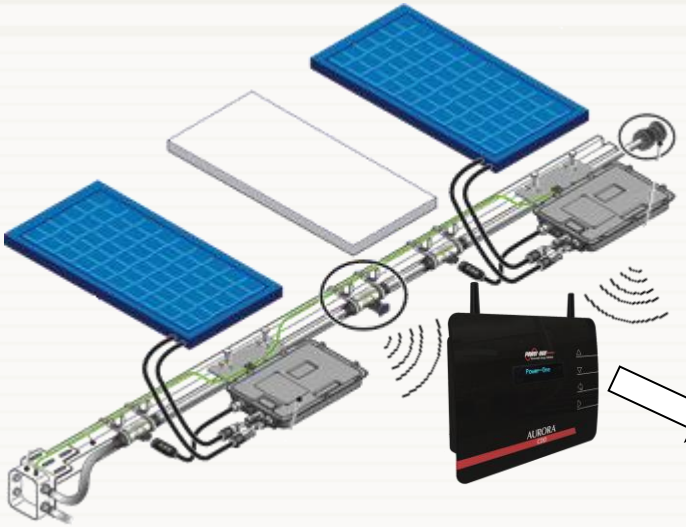
Micro Electrical

PARAMETER	MICRO-0.25-I	MICRO-0.3-I
	INPUT	
Maximum Input Power P_{dcmax}	265 W	320 W
Operating Input Range V_{dcmin}...V_{dcmax}	12...60 V	12...60 V
MPP Input range V_{MPPmin}...V_{MPPmax}	25...50V	30...50V
Maximum Input Voltage $V_{max,abs}$	65 V	65 V
Maximum Input Current $I_{dcmax,abs}$	10.5 A	10.5 A
Start Up Input Voltage V_{start}	25 V	25 V
Number of DC Inputs Pairs	1	1
DC Connection Type	PV connector Amphenol H4 / MC4	PV connector Amphenol H4 / MC4
	OUTPUT	
AC Grid Connection	208V / 240V / 230V	208V / 240V / 230V
Rated Power ($P_{ac,r}$)	250 W	300 W
AC Voltage Range (V_{acmin}...V_{acmax})	183...229 V / 211...264 V / 180...264 V	183...229 V / 211...264 V / 180...264 V
Maximum Output Current ($I_{ac,max}$)	1.3 A	1.5 A
Rated Frequency (f_r)	50 - 60 Hz	50 - 60 Hz
Nominal Power Factor ($Cosphi_{ac,r}$)	> 0.95	> 0.95
Output Over Voltage Protection - Varistor	yes	yes

Confidential

AURORA MICRO

Highest efficiency in the market 96.5% CEC



Wireless communication gateway CDD

web

User-friendly free of charge web-portal data monitoring

Confidential

power-one
A MEMBER OF THE ABB GROUP

Installation - Overview

Confidential
power-one® A MEMBER OF THE ABB GROUP

AURORA MICRO Communication Architecture

Local Monitoring with AURORA Integrated Web Server

Wifi or Ethernet

LAN Access Point

User Internet Connection

Wifi or Ethernet

Wireless Communication

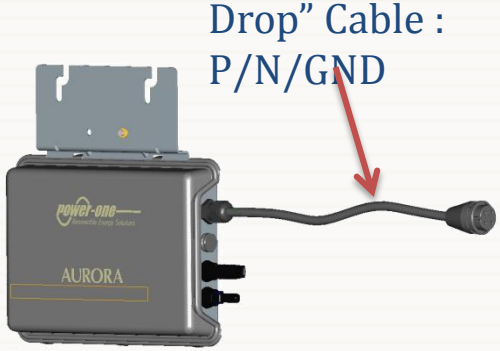
Energy Harvesting with AURORA MICRO

Data Collection with AURORA CDD

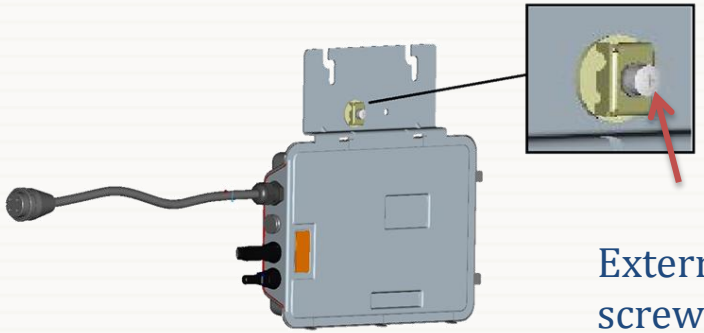
Remote Monitoring with AURORA EASY VIEW / VISION Web Portals

Confidential

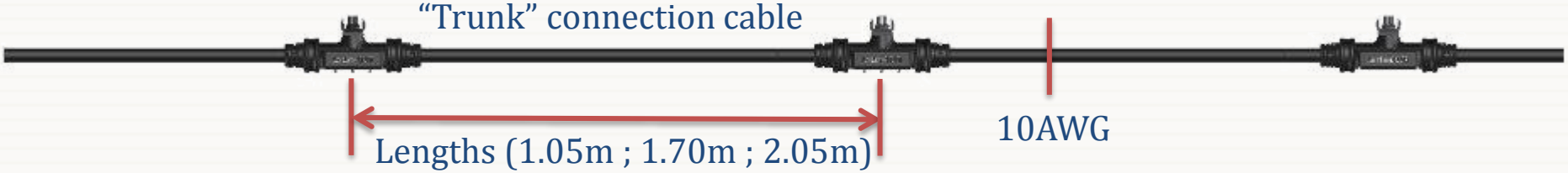
MICRO - AC Trunk Cable system



Drop" Cable :
P/N/GND



External Ground
screw IEC 62109-1

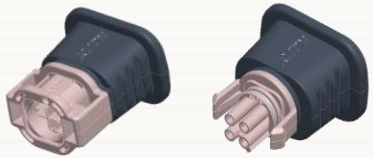


"Trunk" connection cable

Lengths (1.05m ; 1.70m ; 2.05m)

10AWG

Bus terminal (NEMA 4X)



Waterproofed cap (NEMA4X)

Tool

Confidential

Technical details

AURORA MICRO – module inverter

AURORA UNO-2.0/2.5-I-OUTD - 1-phase-string-inverter

Other 1-phase string-inverter

PVI-6.0-TL-OUTD & PVI-8.0-TL-OUTD
3-phase-string-inverter

TRIO - 5.8/7.5/8.5 kW-TL-OUTD
3-phase-string-inverter

TRIO-27.6-TL-OUTD & TRIO-20.0-TL-OUTD
3-phase-string-inverter

power-one® A MEMBER OF THE ABB GROUP

Why Use UNO?

The best solution for residential application

High energy harvesting	• High efficiency • Wide input voltage range • Fast and precise MPP tracking algorithm
High reliability	• Monolithic aluminium alloy die-casting chassis • Natural Convection Cooling • Electrolyte free (only bulk electrolytic capacitors) • IP65 environmental protection rating
Fast installation	• “T” mounting bracket • Lifting cover for an easy access to the connection area • Graphic display
Flexible PV plant planning	• HF-Transformer isolation: negative, positive or floating terminal grounding • Wide input voltage range • 2 kW and 2.5 kW models
Easy to use	• User-friendly interface • Graphic display • Remote connection

Confidential

AURORA® PVI-2.0-I and 2.5-I

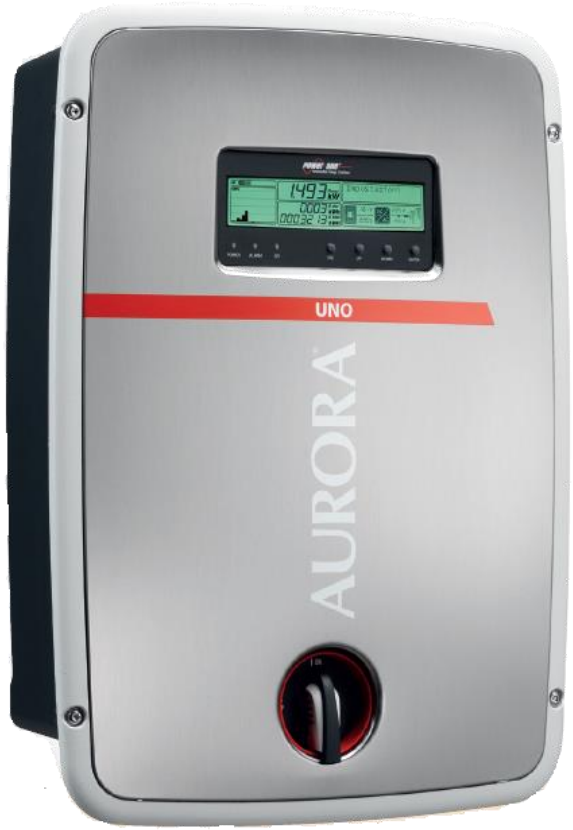
- **Isolated inverters** with HF-Transformer for use **with all types of PV panels**
- **Higher and flat efficiency curve** for consistent performance across wide range of input voltage and output power
- **International version** (optimized stocking)
- New clearly arranged **graphic display**
- **IP 65 enclosure** for unlimited outdoor application
- Integrated **DC switch** (-S Version)
- Precise and **fast MPP tracking algorithm**
- **RS 485 interface** or radio module for connection with PVI-Desktop

Confidential

AURORA UNO

Single phase grid connected inverter 2kW for residential applications

Natural cooling w/o fan
IP65 (NEMA4x) enclosure



Graphic display
easy-to-use interface

Ease of installation:
mounting and wiring

Confidential

power-one® A MEMBER OF THE ABB GROUP

Fast Installation

Easy to use

Flexibility

Technical description:

Die-casting chassis

The cover moves up to enter the configuration (rotary switches for installation country selection and grounding option) and the connection area (AC side and communication)

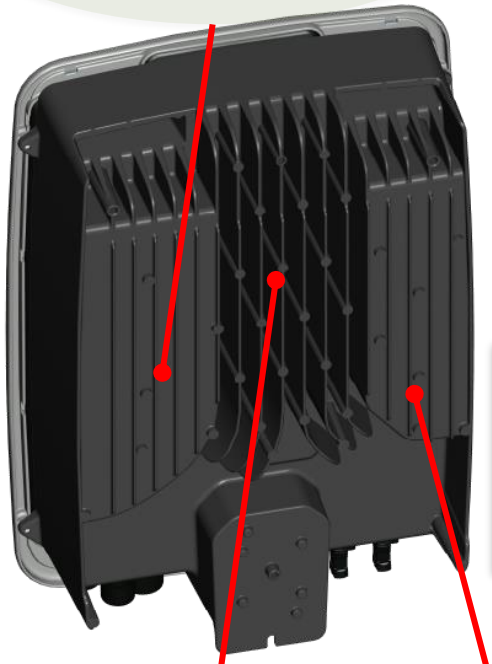
The **“T” mounting** bracket allows a very easy wall installation.

Confidential

power-one® A MEMBER OF THE ABB GROUP

Technical description: Die-casting chassis

High frequency isolation transformer and output chokes "pocket"



optimal thermal exchange between components and ambient thanks to reduced thermal resistance

electronic components work at lower temperature **for a greater reliability and lifetime**

die-casting technology allows to have **only one gasket**

reduced risk of water penetration

"Wings" area: active devices

Input chokes "pocket"

Confidential

Technical description: Electrolyte-free technology - no fans and IP65 enclosure

No fans and **no electrolytic** capacitors except for bulk caps

Removing two of the main causes of failures turns into the best level of reliability for our products

IP65 enclosure with rear heatsink

The rear heat sink allows to perform an easy maintenance from the front of the inverter

Confidential

Available models

UNO-2.0-I-OUTD-S

UNO-2.5-I-OUTD-S

HF-transformator

UNO-2.0-I-OUTD

UNO-2.5-I-OUTD

Negative and positive Ground connection selectable on the field (NG by default)

Country code selection using rotary dip switches

Application Note: configuration

GRIDSTANDARD

UNO inverters are **Universal Standard** and the Grid Standard can be selected during the installation using the **rotary switches**, according to the following table

If required, the **display language** can be changed from the default. Options: English, German, French, Italian, Spanish, Czech, Dutch

1	2	Grid Standard	Display Language
0	0	Not assigned	ENGLISH
0	1	VDE 0126 @230V	GERMAN
0	5	ENEL @230V	ITALIAN
0	6	SPAIN @230V	SPANISH
0	7	UK G83@230V	ENGLISH
0	9	IRELAND@230V	ENGLISH
0	A	AUSTRALIA @ 230V	ENGLISH
0	B	ISRAEL @ 230V	ENGLISH
0	D	FRANCE @230V	FRENCH
0	E	BENELUX @230V	FRENCH
0	F	GREECE @230V	ENGLISH
1	0	PORTUGAL @230V	ENGLISH
1	1	CORSICA @230V	FRENCH
1	2	HUNGARY @230V	ENGLISH
1	3	CHINA @ 230V	ENGLISH
1	6	CHECA Republic @230 V	ENGLISH
1	7	GERMANY- VDE AR-N-4105 @230V	GERMAN
1	8	ENEL CEI-021 @ 230V	ITALIAN

Confidential

AURORA® PVI-2.0-I and 2.5-I

String inverters 2.0 and 2.5kW – Single phase with HF transformer	*PVI-2.0-I-OUTD*	*PVI-2.5-OI-UTD*
Input parametrs (DC Side)		
Rated DC Power [kW]	2.1	2.6
Maximal recommended DC Power [kW]	2.3	2.9
Input voltage range [V]	0.7x VStart to 520 (300V rated)	
Full power MPP range [V]	200 - 470	200 - 470
Full asymm. Operation MPP range	N/A	N/A
Max. Input Voltage [V]	520	
Input Activation Voltagan VStart [V]	200 default (adjustable 120 - 350 via Display and Software)	
Number of independent MPP inputs	1	
Maximal Input Power per MPPT [kW]	2.3	2.9
Number of DC Inputs(Connection pairs)	2	
Maximal Input Current per MPPT [A]	10 (15 Short Circuit Current)	12.8 (15 Short Circuit Current)
DC Varistor	2	
DC Switch	Integrated (600Vdc/16A)	

Confidential

AURORA® PVI-2.0-I and 2.5-I

String inverters 2.0 and 2.5kW – Single phase with HF transformer	***PVI-2.0-I-OUTD***	***PVI-2.5--IOUTD***
Output (AC Side)		
Rated AC power [kW]	2.0	2.5
Maximal AC power [kW]	2.2*	2.75*
Grid connection	Single phase	
Rated AC voltage [V]	230	
Maximal AC Voltage Range [V]	180-264	
Maximal AC Current (Imax) [A]	10.0	12
Short Circuit Current	15.0	15.0
Rated Grid Fequency [Hz]	50	
AC Varistor	2 P-N; P-PE	
Rated Power Factor cos(φ)	1	
Total Current Harmonic Distortion (THD)	<2% at Rated power and sinusoidal voltage	
Maximal Efficiency	96.3%	
Euro Efficiency (CEC)	95.0%	
Standby Cosumption	< 8W	
Feed in Power Treshold [W]	24	
Night Time Power loss [W]	< 0.6W	
Isolation	Yes (HF Trafo)	

*** In Germany limited to 2.0kW resp. 2.5kW**

Confidential

power-one® A MEMBER OF THE ABB GROUP

Technical details

AURORA MICRO – module inverter

AURORA UNO-2.0/2.5-I-OUTD - 1-phase-string- inverter

Other 1-phase string-inverter

PVI-6.0-TL-OUTD & PVI-8.0-TL-OUTD
3-phase-string-inverter

TRIO - 5.8/7.5/8.5 kW-TL-OUTD
3-phase-string-inverter

TRIO-27.6-TL-OUTD & TRIO-20.0-TL-OUTD
3-phase-string-inverter

power-one®
A MEMBER OF THE ABB GROUP

Why use PVI-3.0/3.6/4.2-OUTD ?

High energy harvesting	• High efficiency curve • Double independent MPPTs • Fast and precise MPP tracking algorithm
High reliability	• Natural convection cooling • IP65 environmental protection rating • Wide temperature range
Fast installation	• Easy mounting system • Multi-country selection • Handy connection area
Easy to use	• User-friendly display • RS485 interface as standard
Flexible PV plant planning	• Wide input voltage range • 3.0 / 3.6 and 4.2 KW models • Reactive power capability and 70% controllability

Confidential

AURORA® PVI-3.0/3.6/4.2-OUTD

- IP65 (NEMA 4) completely sealed unit box for use in harshest environmental conditions
- Extreme compact outdoor design: 4200W output power in box (547mm x 325mm x 208mm) and weight less than 17 kg
- Heat sink in front keeps inverter clean and the cooling remains very effective
- Tranformerless. Efficiency 96,8%
- 2 independent MPP Inputs
- Overload: PVI-4.2 works up to 4.6 kW under most conditions
- 2- lines LCD Display
- DC connectors - standard DC Multi-Contact MC4
- Screw terminal block (3.0/3.6/4.2) or terminal clamp (PVI-6000) on AC side
- RS485 interface and USB service connection
- International version

Confidential

AURORA® PVI-3.0/3.6/4.2-TL-OUTD & PVI-5000/6000-OUTD

String Inverters 3kW - 6kW – Single phase	***PVI-3.0-TL-OUTD***	***PVI-3.6-TL-OUTD***	***PVI-4.2-TL-OUTD***	***PVI-5000-OUTD***	***PVI-6000-OUTD***
Input parametrs (DC Side)					
Rated DC Power [kW]	3.12	3.75	4.38	5.15	6.18
Maximal recommended DC Power [kW]	3.5	4.15	4.82	5.3	6.4
Input voltage range [V]	0.7x VStart to 580 (360 rated)				
Full power MPP range [V]	160-530	120-530	140-530	140-530	170-530
Full asymm. Operation MPP range	200-530 @2kW	190-530 @3kW	190-530 @3kW	220-530 @ 4kW	220-530 @ 4kW
Max. Input Voltage [V]	600				
Input Activation Voltagan VStart [V]	200 rated (adjustable 120-350 via Software and Display)				
Number of independent MPP inputs	2	2	2	2	2
Maximal Input Power per MPPT [kW]	2	3	3	4	4
Number of DC Inputs(Connection pairs)	2 (1 per MPPT)	2 (1 per MPPT)	3 (2 on MPPT 1 1 on MPPT 2)	4 (2 per MPPT)	4 (2 per MPPT)
Maximal Input Current per MPPT [A]	10 (12.5)	16 (20)	16 (20)	18 (22)	18 (22)
DC Varistor	4 (2 per MPPT)				
DC Switch	Integrated (600Vdc/25A)				

Confidential

AURORA® PVI-3.0/3.6/4.2-TL-OUTD & PVI-5000/6000-OUTD

String inverters 3-6–6kW Single phase	*PVI-3.0-TL-OUTD*	*PVI-3.6-TL-OUTD*	*PVI-4.2-TL-OUTD*	*PVI-5000-OUTD*	*PVI-6000-OUTD*
Output (AC Side)					
Rated AC power [kW]	3	3.6	4.2	4.6	6.0
Maximal AC power [kW]	3.3*	3.96*	4.6*	5.0	6.0
Grid connection	single phase				
Rated AC voltage [V]	230				
Maximal AC Voltage Range [V]	187.2-224.6 (208 Vr) / 216-259.2 (240 Vr) / 249.3-299.2 (277 Vr)				
Maximal AC Current (Imax) [A]	14,5	17,2	20	22	30
Short Circuit Current	16	19	22	30	30
Rated Grid Fequency [Hz]	50				
AC Varistor	2 (Live - Neutral / Live - PE)				
Rated Power Factor cos(φ)	1 (adjustable ±0.9)				
Total Current Harmonic Distortion (THD)	<3.5% at Rated power and Sinusoidal voltage			<2%	
Maximal Efficiency	96.8%			97%	
Euro Efficiency (CEC)	96%			96,5%	
Standby Cosumption	8				
Feed in Power Treshold [W]	20				
Night Time Power loss [W]	< 2				
Isolation	No (Transformerless)				

*** In Germany limited to 3.0, 3.6 resp. 4.2 kW**

Confidential

power-one® A MEMBER OF THE ABB GROUP

Technical details

AURORA MICRO – module inverter

AURORA UNO-2.0/2.5-I-OUTD - 1-phase-string-inverter

Other 1-phase string-inverter

PVI-6.0/8.0/10.0/12.0-TL-OUTD
3-phase-string-inverter

TRIO - 5.8/7.5/8.5 kW-TL-OUTD
3-phase-string-inverter

TRIO-27.6-TL-OUTD & TRIO-20.0-TL-OUTD
3-phase-string-inverter

power-one® A MEMBER OF THE ABB GROUP

Why use PVI-6.0/8.0/10.0/12.0?

The best solution for rooftop installations

High energy harvesting

- High efficiency
- Wide input voltage range (up to 900V)
- Double Independent MPPTs
- Fast and precise MPP tracking algorithm

High reliability

- Natural Convection Cooling
- Electrolyte-free (no electrolytic capacitors)
- IP65 environmental protection rating
- Designed for 12.5kW power range

Fast installation

- Easy mounting system
- Multi-country selection

Flexible PV plant planning

- Wide input voltage range (up to 900V)
- Available with DC switch and fuses

Confidential

General overview

PVI-6.0/8.0/10.0/12.0 -TL-OUTD

Natural convection cooling
(internal fans only for inside air mixing)

Electrolyte-free technology
for the highest reliability

Double MPPT
Wide input voltage range
(max 900VDC)
Flat efficiency curve

Different configurations
for the highest flexibility
(single/double MPPT)

IP 65 chassis
for outdoor installation

Very light
and
compact design

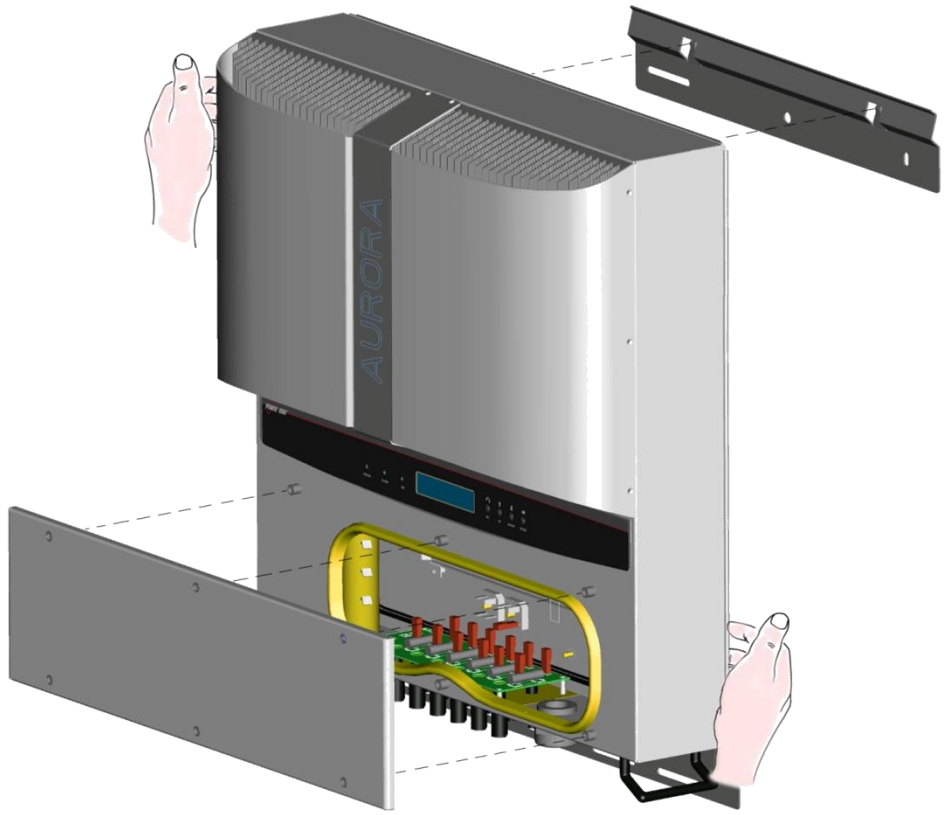
Front heat sink with solar umbrella

Installer-friendly
connection system

Country code
On-site selection
(by display)

Confidential

PVI-6.0/8.0/10.0/12.5-TL-OUTD: easy to handle



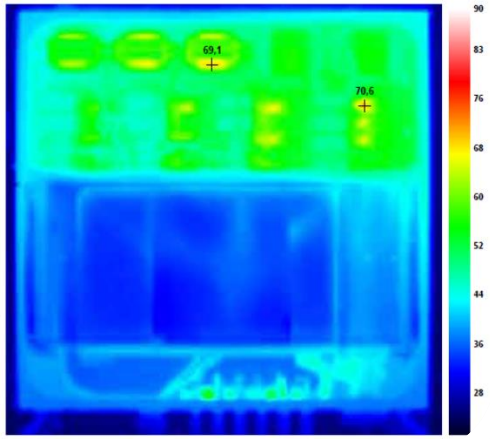
Installer-friendly wall mounted system

The inverter's wall connection system has been designed so that you'll be able to install your own product just performing a few easy on-site actions.

Confidential

AURORA® PVI-6.0/8.0/10.0/12.5-TL-OUTD

- Designed for extreme long lifetime
- “Electrolyte free” → 10 years Standard warranty
- Wide temperature range: Maximal power up to 55°C
- Maintenance-free IP65 box with natural convection cooling
- 2 independent MPPT input chanels
- Extreme wide input voltage range: 200-850V DC
- Easy configuration for use with any type of Module and technology
- High and flat efficiency curve:
  high performance in wide input voltage and output power range



Confidential

AURORA® PVI-6.0/8.0/10.0/12.5-TL-OUTD

String Inverters PVI-6, 8, 10 and 12.5 kW Three phase	***PVI-6.0-TL-OUTD***	***PVI-8.0-TL-OUTD***	***PVI-10.0-OUTD***	***PVI-12.5-OUTD***
Input parametrs (DC Side)				
Rated DC Power [kW]	6.2	8,25	10.4	13.0
Maximal recommended DC Power [kW]	6.8	9	11.4	14.3
Input voltage range [V]	0.7x VStart - 850 (580 rated)			
Full power MPP range [V]	200 - 750	270 - 750	300 - 750	360 - 750
Full asymm. Operation MPP range	250 – 750 @ 4.2kW	320 – 750 @ 5.5kW	360-750 @ 6.5kW	445-750 @8kW
Max. Input Voltage [V]	900			
Input Activation Voltagan VStart [V]	360 default (Adjustable 250 - 500 via Display and Software)			
Number of independent MPP inputs	2	2	2	2
Maximal Input Power per MPPT [kW]	4.2	5.5	6.5	8.0
Number of DC Inputs (Connection pairs)	2 (-S Version) 3 (Standard or -FS Version) for each MPPT			
Maximal Input Current per MPPT [A]	17 (22 Short circuit)		18 (22 Short circiuit)	
DC Varistor	4 (2 for each MPPT)			
DC Switch	Integrated (for S- and FS-versions)			

Confidential

AURORA® PVI-6.0/8.0/10.0/12.5-TL-OUTD

String inverters PVI-6, 8, 10 and 12.5 kW Three phase	***PVI-6.0-TL-OUTD***	***PVI-8.0-TL-OUTD***	***PVI-10.0-OUTD***	***PVI-12.5-OUTD***
Output (AC Side)				
Rated AC power [kW]	6.0	8.0	10.0	12.5
Maximal AC power [kW]	6.6*	8.9*	11.0*	13.8*
Grid connection	Three phase			
Rated AC voltage [V]	3x400			
Maximal AC Voltage Range [V]	311-456			
Maximal AC Current (Imax) [A]	10.0	13.0	16.6	20
Short Circuit Current	12.0	15.0	19.0	22
Rated Grid Fequency [Hz]	50			
AC Varistor	3 (3 Starconection)			
Rated Power Factor cos(φ)	1 (adjustable±0.9)			
Total Current Harmonic Distortion	<2% at Rated power and Sinusoidal voltage			
Maximal Efficiency	97.6 %		97.8%	
Euro Efficiency (CEC)	96.5 %		97.3%	
Standby Cosumption [W]	< 10			
Feed in Power Treshold [W]	< 30			
Night Time Power loss [W]	< 2			
Isolation	No (transformerless)			

*** In Germany limited to 6.0, 8.0, 10.0, 12.5kW**

Confidential

power-one® A MEMBER OF THE ABB GROUP

Hockenheim: On a length of 405 meters, 4,716 solar panels were installed. This corresponds to a power of 848.88 kWp, which are fed with Aurora inverters into the grid. PVI-12.5 were used.

Confidential

Technical details

NEW!

AURORA MICRO – module inverter

AURORA UNO-2.0/2.5-I-OUTD - 1-phase-string-inverter

Other 1-phase string-inverter

PVI-6.0/8.0/10.0/12.5-TL-OUTD
3-phase-string-inverter

TRIO - 5.8/7.5/8.5 kW-TL-OUTD
3-phase-string-inverter

TRIO-27.6-TL-OUTD & TRIO-20.0-TL-OUTD
3-phase-string-inverter

power-one
A MEMBER OF THE ABB GROUP

Product overview

- Three-phase transformerless inverters
- Designed for residential applications
- Suitable for outdoor installation
- Three different power ratings (5,800VA, 7,500VA and 8,500VA nominal power)

Confidential

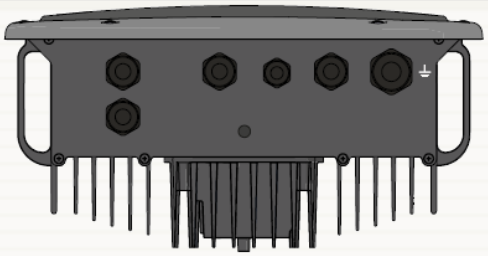
Product overview

Versions:

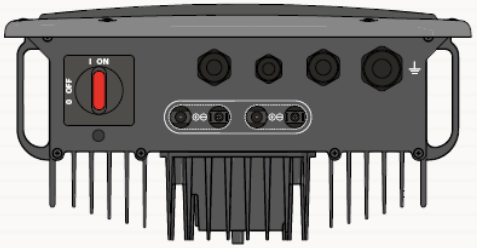
Standard

S: Standard version plus
DC disconnect switch and
MC4 type inputs

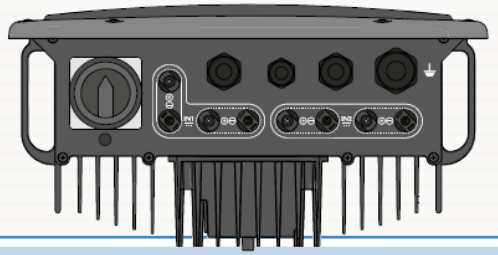
TRIO-X.X-TL-OUTD



TRIO-5.8-TL-OUTD-S



TRIO-7.5\8.5-TL-OUTD-S



Confidential

Features overview

- 2 independent MPPT channels for TRIO-7.5/8.5 and 1 MPPT channel for TRIO-5.8
- 2 DC input per MPP tracker, possibility to be configured in parallel
- Universal standard grid connection
- Reactive power management

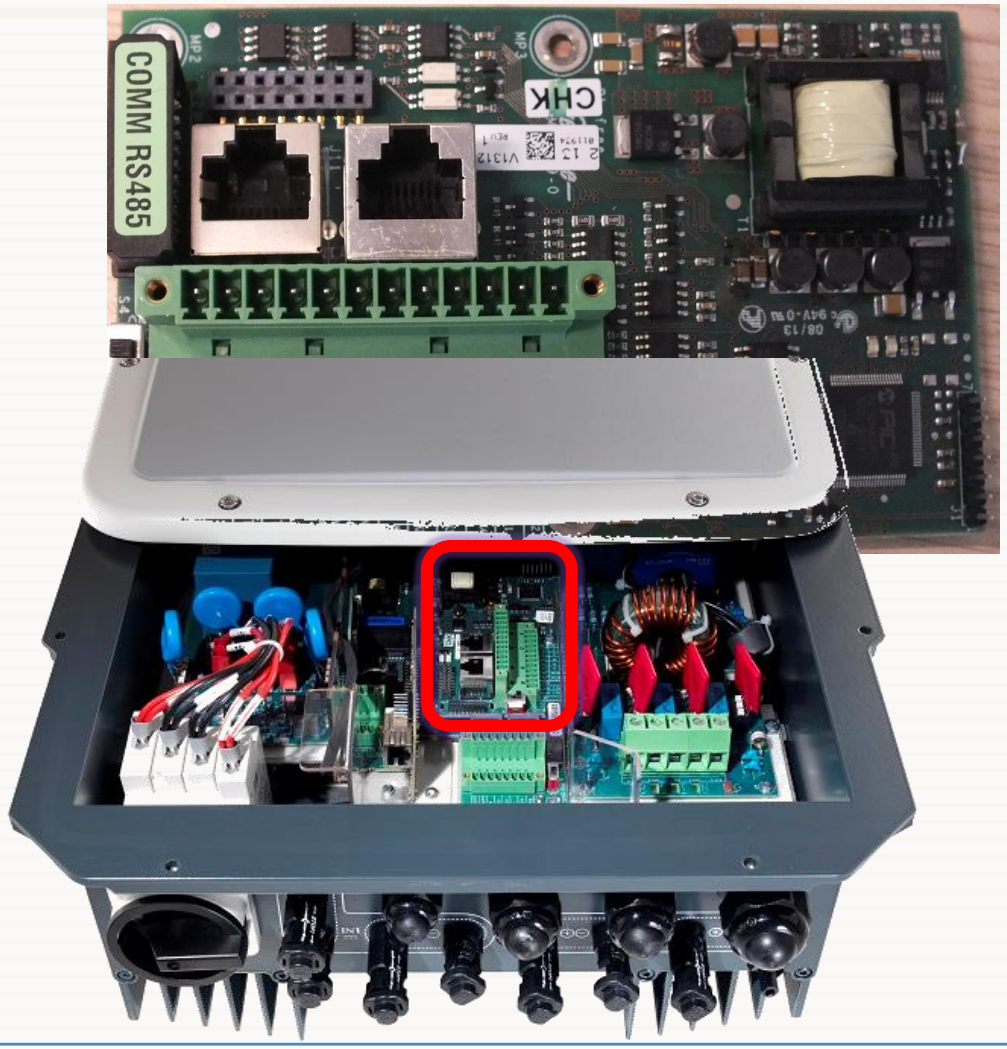
Confidential

Characteristics overview

- Sliding cover
- Upgradeable firmware by the means of SD card.
- Datalogger and smart grid functionalities on expansion slot
  - ✓ “Service board” expansion card option
  - ✓ Ethernet expansion card option (Modbus/TCP web server)

Confidential

Characteristics overview

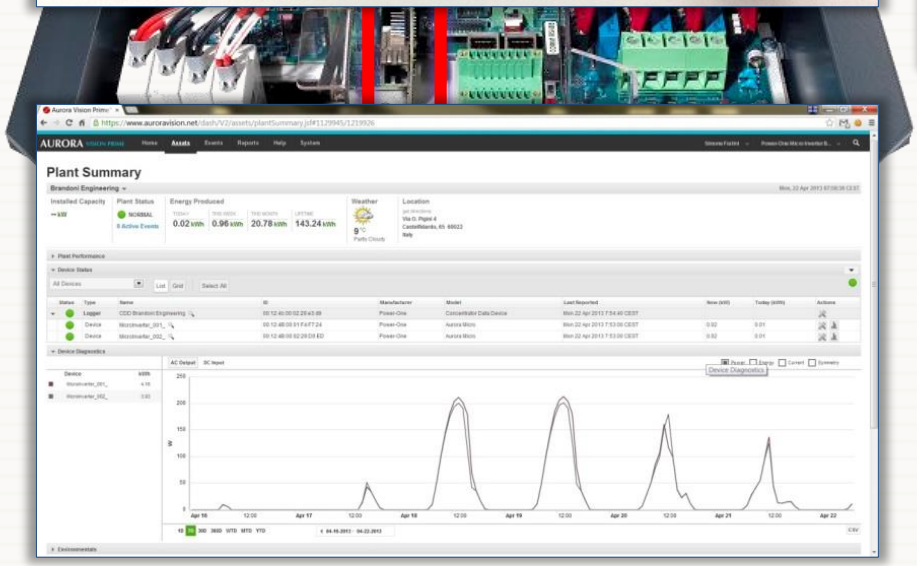


Service Board

- Power Management Unit (PMU) functionalities
- External sensor inputs
  - ✓ AN1
  - ✓ AN2
  - ✓ PT100/PT1000
- Additional RS485 with MODBUS protocol

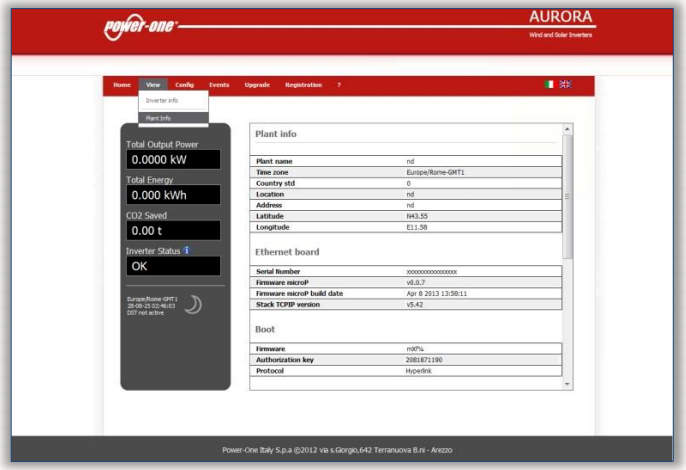
Confidential

Characteristics overview



Ethernet board

- Remote control and monitoring with AURORA VISION
- Integrated web server
- Remote upgrading functionalities



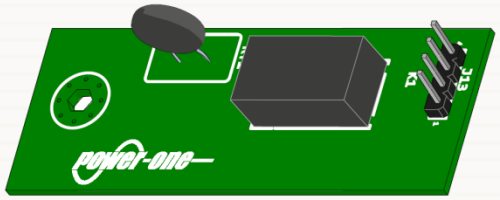
Confidential

power-one
A MEMBER OF THE ABB GROUP

Tecnical description: other options

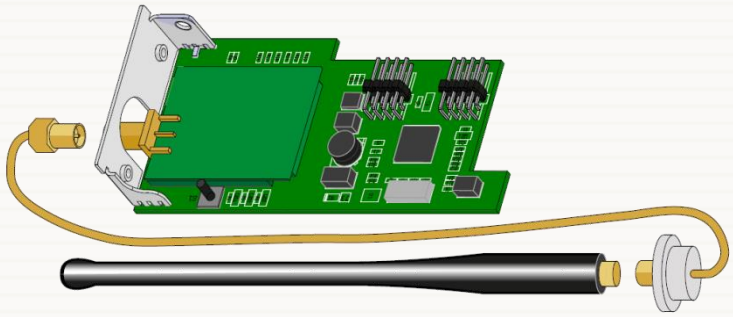
NEGATIVE GROUNDING KIT

To be installed removing the front cover, for the ground connection of the DC negative input



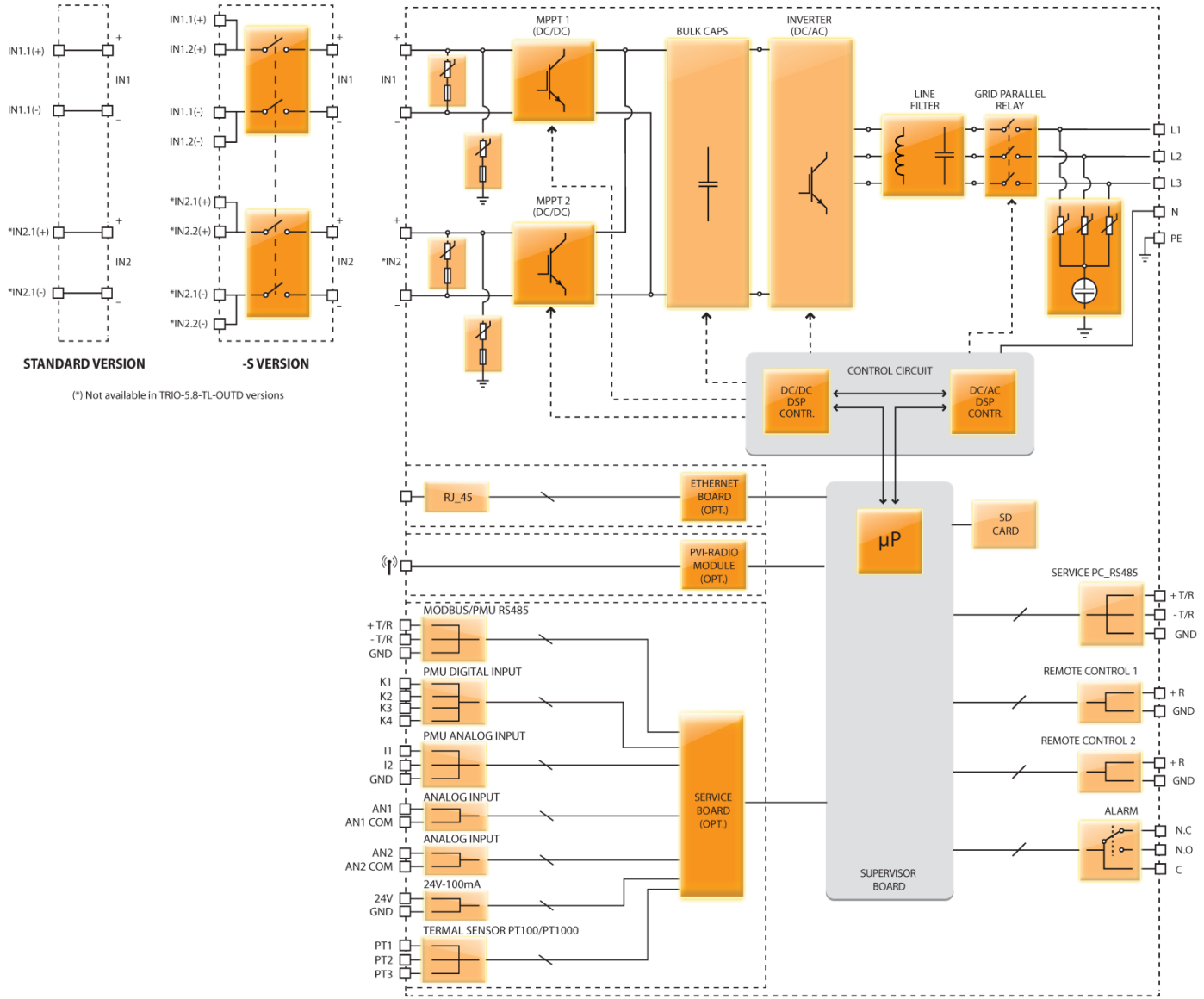
PVI-RADIOMODULE

To be installed in the expansion slot, for the radio communication



Confidential

Technical description: block diagram



Technical details

AURORA MICRO – module inverter

AURORA UNO-2.0/2.5-I-OUTD - 1-phase-string-inverter

Other 1-phase string-inverter

PVI-6.0/8.0/10.0/12.5-TL-OUTD
3-phase-string-inverter

TRIO - 5.8/7.5/8.5 kW-TL-OUTD
3-phase-string-inverter

TRIO-27.6-TL-OUTD & TRIO-20.0-TL-OUTD 3-phase-string-inverter

power-one® A MEMBER OF THE ABB GROUP

Why use TRIO?

The best solution for mid-large commercial PV applications.

High energy harvesting	• High efficiency • Wide input voltage range (up to 1000V) • Double independent MPPTs • Fast and precise MPP tracking algorithm
High reliability	• Natural convection cooling • Electrolyte free (no electrolytic capacitors) • IP65 environmental protection rating
Fast installation	• Detachable Wiring Box • Graphic display
Easy to use	• Graphic display • Remote connection
Flexible PV plant planning	• Wide input voltage range (up to 1000V) • 4 different options for the wiring box • 20.0 and 27.6 kW models

Confidential

TRIO-20.0/27.6-TL-OUTD

High energy harvesting

High reliability

Flexible PV plant planning

Intermediate product between string and central inverters

TRIO-20.0-TL-OUTD
TRIO-27.6-TL-OUTD

Performance: Maximal efficiency: 98,3% - EURO Efficiency: 98,0%; Integrated MPPT Scanning Function.

Reliability: Elektrolyt-free, natural convection cooling, full „fan-free“.

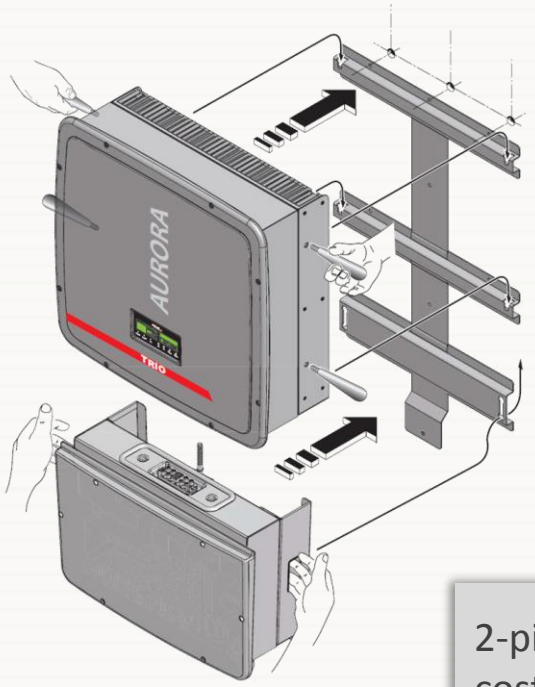
Flexibility: Two independent MPPT (parallel) for maximal configuration flexibility up to 1000 Vdc input voltage.

Confidential

power-one® A MEMBER OF THE ABB GROUP

AURORA TRIO

3-phase grid-connected string inverters from 5.8kW to 27.6kW



2-piece construction
cost effective handling
and installation

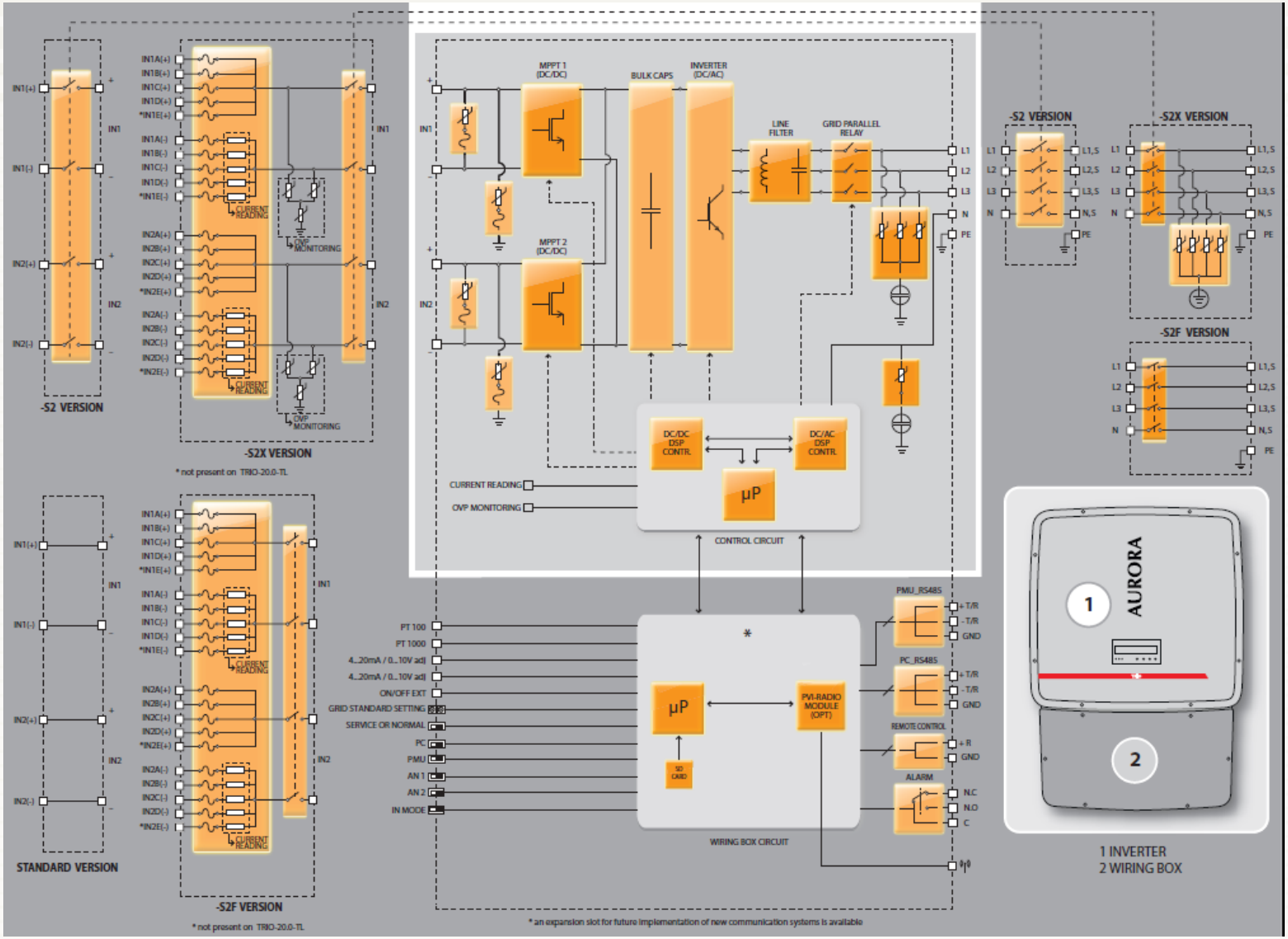
Stringcombiner available in multiple configurations including

- MOV
- DC Fuses
- AC and DC disconnects
- String current sensing

Confidential

power-one® A MEMBER OF THE ABB GROUP

AURORA® PVI-20.0/27.6-TL-OUTD

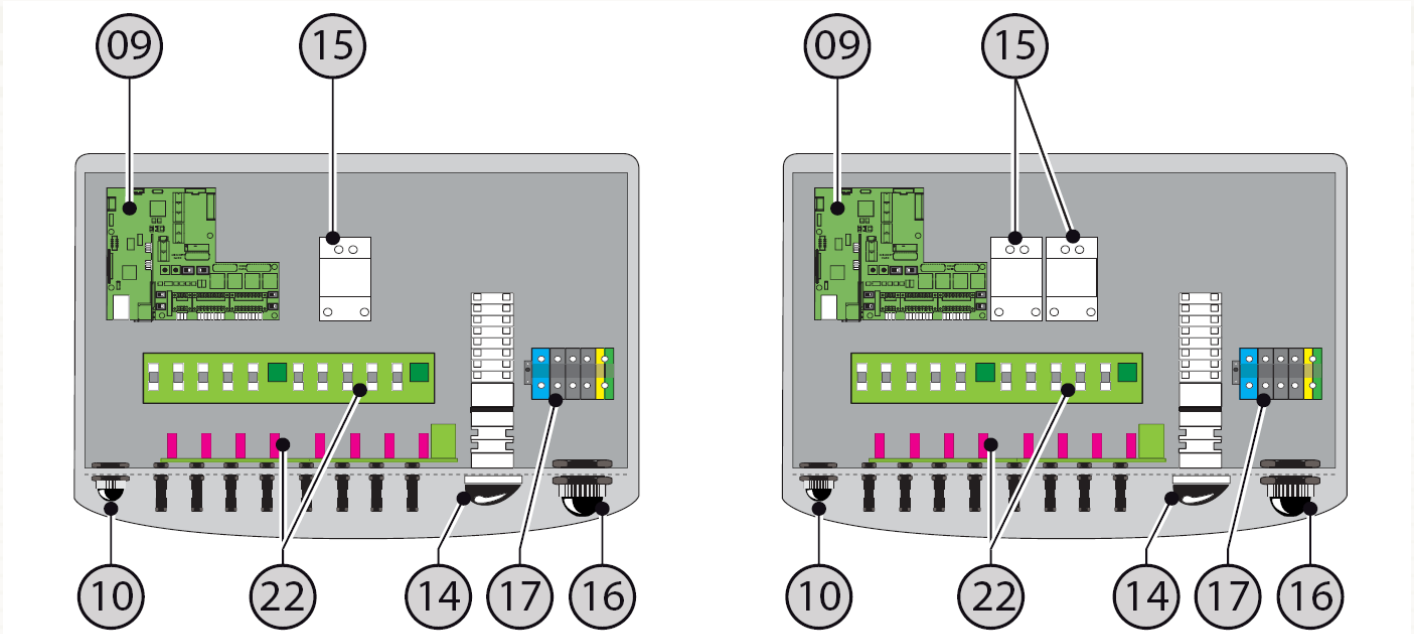


Blockdiagrams 20.0/27.6kW vary in "S2X" (4x2) per MPPT resp. (5x2) per MPPT

Confidential

power-one® A MEMBER OF THE ABB GROUP

AURORA® PVI-20.0/27.6-TL-OUTD



Ref.	Description	Ref.	Description
09	Communication board	16	AC Cable gland
10	Service cable glands	17	AC output terminal block
14	AC- DC Switch	22	String fuses
15	DC overvoltage surge arresters		

Special versions S1J and S2J

Confidential

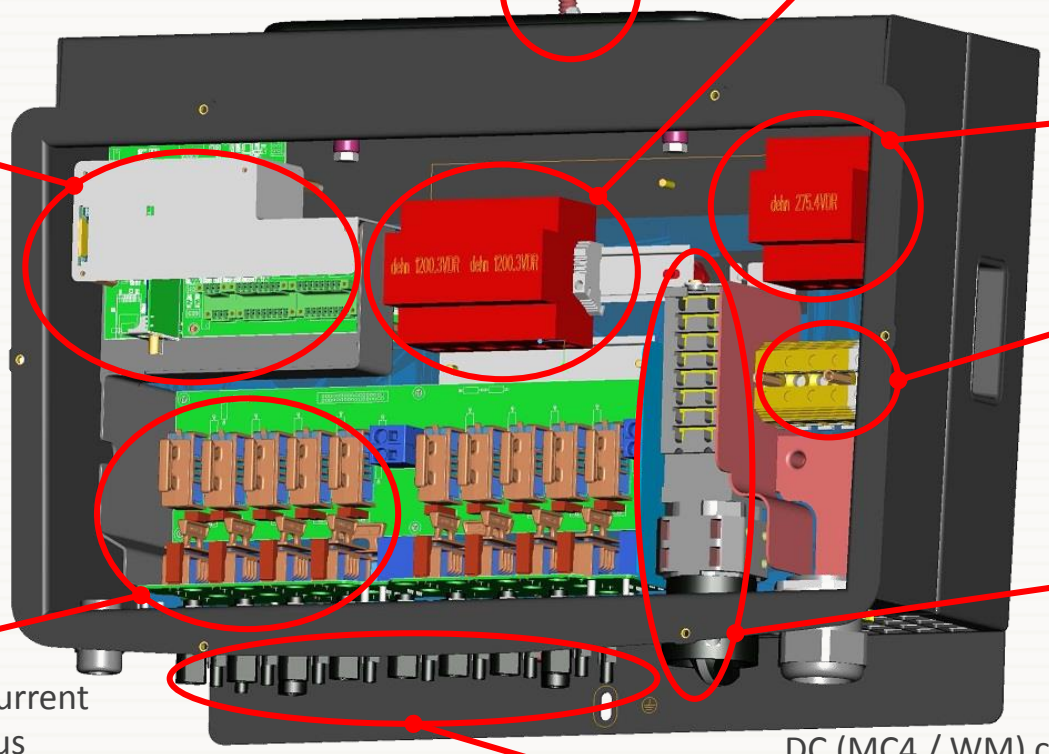
power-one® A MEMBER OF THE ABB GROUP

Fast Installation

Flexibility

Technical description:

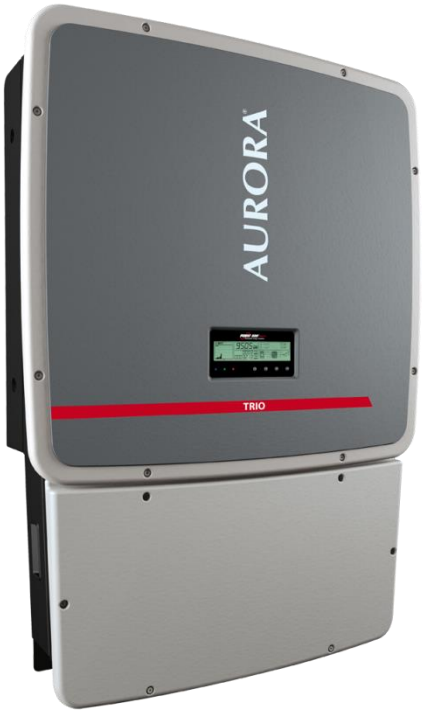
Detachable wiring box (S2X Version)



Confidential

power-one® A MEMBER OF THE ABB GROUP

Technical description



No electrolytic capacitors, no fans

High reliability for our products

IP65 housing with rear heatsink

The rear heat sink allows to perform **easy maintenance** from the front of the inverter

Confidential

Application Note: configuration

GRID STANDARD

TRIO inverters are **Universal Standard** and the Grid Standard can be selected during the installation using the rotary switches a05, according to the following table

Selector 1	Selector 2	Grid standard	Display LABEL
0	0	Standard de-selected	Not valid
0	1	GERMANY – VDE 0126 @ 400V	*VDE 0126*
0	5	ENEL @ 400V	*ENEL*
0	6	SPAIN RD1699 @ 400V	*RD 1699*
0	7	UK – G83 @ 400V	*UK G83*
0	8	UK – G59 @ 400V	*UK G59*
0	9	IRELAND @ 400V	*IRELAND*
0	A	AUSTRALIA @ 400V	*AS 4777*
0	B	ISRAEL @ 400V	*ISRAEL*
0	C	GERMANY – BDEW @ 400V	*BDEW*
0	D	FRANCE @ 400V	*FRANCE*
0	E	NETHERLANDS @ 400V	*NETHERL.*
0	F	GREECE @ 400V	*GREECE*
1	0	PORTUGAL @ 400V	*PORTUGAL*
1	1	CORSICA @ 400V	*CORSICA*
1	2	HUNGARY @ 400V	*HUNGARY*
1	3	CHINA @ 400V	*CHINA*
1	4	KOREA @ 380V	*KOREA*
1	5	TAIWAN @ 400V	*TAIWAN*
1	6	CHECA Republic @ 400V	*CZECH*
1	7	GERMANY – VDE AR-N-4105 @ 400V	*VDE 4105*
1	8	ENEL CEI-021 @ 400V EXTERNAL Prot.	*CEI021 IN*
1	9	ENEL CEI-021 @ 400V INTERNAL Prot.	*CEI021 EX*
1	B	SOUTH AFRICA @ 400V	*S.AFRICA*
1	C	SPAIN RD 1565 @ 400V	*RD 1565*
1	D	BELG C10-11 100% @ 400V	*C1011 100*
1	E	BELG C10-11 110% @ 400V	*C1011 110*
1	F	BRAZIL @ 380V	*BRAZIL*
2	0	TURKEY LV @400V	*TURKEY LV*
2	1	ROMANIA @400V	*ROMANIA*
2	2	SLOVENIA @400V	*SLOVENIA*
2	3	TURKEY HV @400V	*TURKEY HV*
2	4	CEI-016 @ 400V	*CEI 016*

Confidential

AURORA® PVI-20.0/27.6-TL-OUTD

String Inverters 20.0 and 27.6kW – Three phase	*PVI-20.0-TL-OUTD*	*PVI-27.6-TL-OUTD*
Input parametrs (DC Side)		
Rated DC Power [kW]	20.75	28.6
Maximal recommended DC Power [kW]	23.32	29.25
Input voltage range [V]	0.7x VStart - 970 (620 rated)	
Full power MPP range [V]	440-800	500-800
Full asymm. Operation MPP range	480-800 @ 6.5kW	500-800 @8kW
Max. Input Voltage [V]	1000V	
Input Activation Voltagan VStart [V]	360 rated (adjustable 250 - 500 via Display and Software)	
Number of independent MPP inputs	2	2
Maximal Input Power per MPPT [kW]	12	16
Number of DC Inputs(Connection pairs)	8 (4 pro MPPT)[1)]	10 (5 pro MPPT) [1)]
Maximal Input Current per MPPT [A]	25 (30 Short circuit)	32 (40 Short circuit)
DC Varistor	Varistors; S2X Version: Typ II Arrester	
DC Switch	Integrated (1000Vdc/40A/MPP)	

[1)] Only S2F and S2X Version

Confidential

AURORA® PVI-20.0/27.6-TL-OUTD

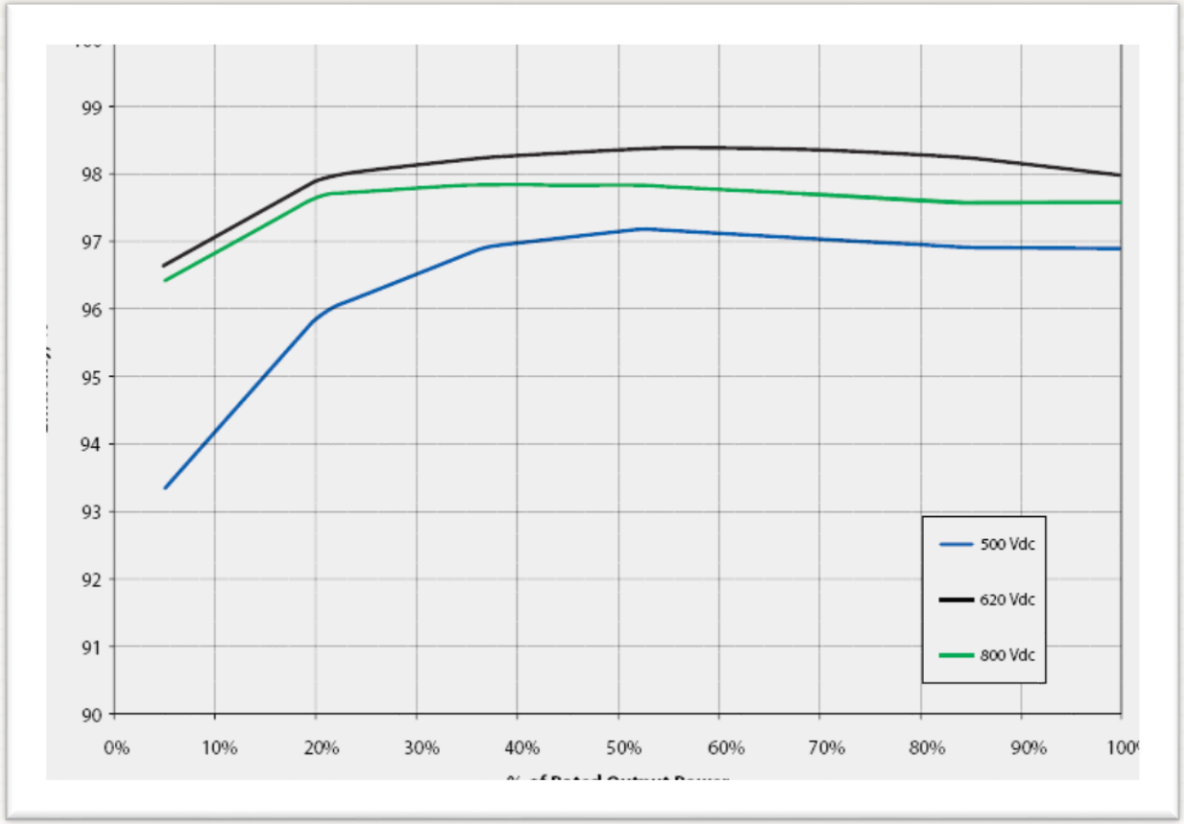
String inverters PVI-20.0 and PVI-27.6 – Three phase	***PVI-20.0-OUTD***	***PVI-27.6-OUTD***
Output (AC Side)		
Rated AC power [kW]	20.0	27.6
Maximal AC power [kW]	22.0*	30.0*
Grid connection	Three phase	
Rated AC voltage [V]	3x400	
Maximal AC Voltage Range [V]	320-480	
Maximal AC Current (Imax) [A]	33.0	45.0
Short Circuit Current	34.0	46.0
Rated Grid Fequency [Hz]	50	
AC Varistor	Varistors; S2X Version: Typ II)	
Rated Power Factor cos(φ)	1 (adjustable ±0.9)	
Total Current Harmonic Distortion (THD)	<2% at Rated power and Sinusoidal voltage	
Maximal Efficiency	98.2%	
Euro Efficiency (CEC)	98.0%	
Standby Cosumption	< 8W	
Feed in Power Treshold [W]	40	
Night Time Power loss [W]	< 2	
Isolation	No (transformerless)	

*** In Germany limited to 20.0kW resp. 27.6kW**

Confidential

power-one® A MEMBER OF THE ABB GROUP

Efficiency curve



TRIO-20.0-TL-OUTD
TRIO-27.6-TL-OUTD

Efficiency curve	%
Max.	98,3%
EURO	98,0%
CEC	98,1%

Confidential

In December 2012 one of the first solar parks in Bosnia and Herzegovina was connected with Power-One inverters to the electricity grid. The 150 kWp park „MK Hodovo 1“ is near Stolac, in the south of the country.

This 999 kWp roof installation in Londerzeel, Belgium, was completed in 2012 with Power-One's very reliable string inverters.

Program

Company presentation

Product overview and technical data

Topology and functions

Installation

Commisioning and operation

Communication and monitoring

Correct sizing with Aurora Designer or Stringsizer

power-one®
A MEMBER OF THE ABB GROUP

Energy conversion to alternating current

Basic functions for a grid-connected inverter

All inverters for grid-connected systems have at least the following core functions:

- **Transformation / DC-AC Conversion**

To transform the direct current produced by the photovoltaic generator into alternate current and adapt it to the voltage level of the electrical grid for input into the grid.

- **Automatic adjustment of the working point by MPPT algorithm**

To harvest the maximum available energy from solar radiation by adjusting the operating point on the power curve typical of the PV generator to make it work at the maximum power point MPP (Maximum Power Point). The maximum power point tracking function from the inverter through a special algorithm is called MPPT

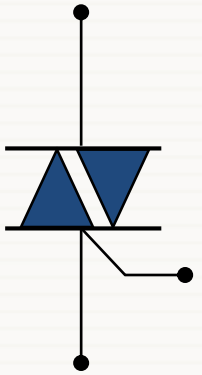
- **Protection and interface device for injecting electricity into the grid in compliance with current legal standards**

Function of monitoring the electrical parameters of the grid, to which one or more electromechanical relay switches are interlocked. These relays allow galvanic separation of the inverter from the grid according to the national legislation/norms. It is not mandatory that these functions are integrated with the inverter, nonetheless all manufacturers offer products which are including the above mentioned protections and interface device (especially for small inverters).

Energy conversion to alternating current

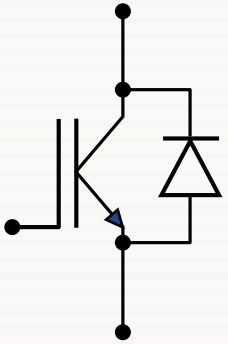
Transformation / DC-AC Conversion

There are two types of static converters used in the field of photovoltaics:



- **Grid-switching inverter**

Industrially-derived, they are based on the use of thyristors or GTOs and traditionally are used to pilot electric motors, including those in the traction sector.
Although these are remarkably sturdy relatively cheap, they are no longer used in photovoltaic applications because they require large filter banks to suppress the current harmonics injected into the grid (fundamental square-wave current) and ensure compliance with EMC requirements.

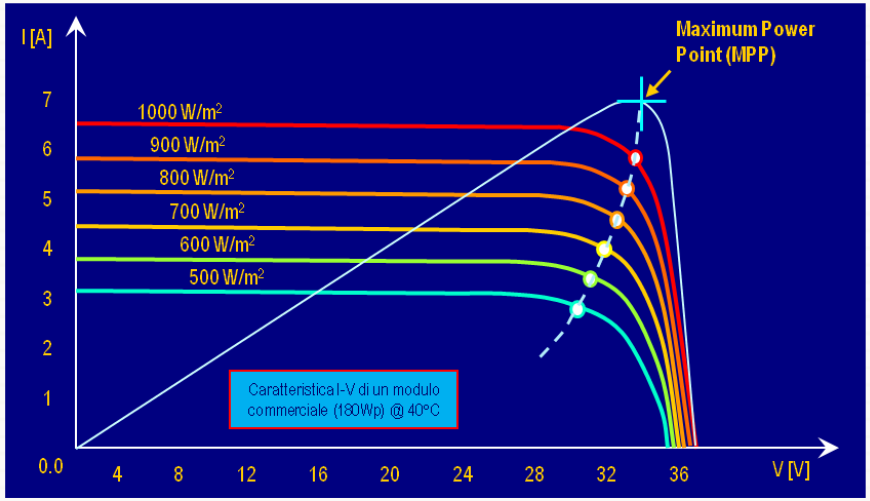


- **Switching Commutation Inverter**

Used in modern conversion systems based on sinusoidal PWM (Pulse Width Modulation), both for applications and photovoltaic converters. This inverter is based on “H” bridge architecture with IGBT (sometimes substituted by the half bridge in low power inverters).
Operating at frequencies much higher than the grid frequency (6-20kHz), they allow a lighter weight and smaller size of the output reconstruction filter and obtain a low harmonic content of the current injected into the grid (THD<5%).

Energy conversion to alternating current

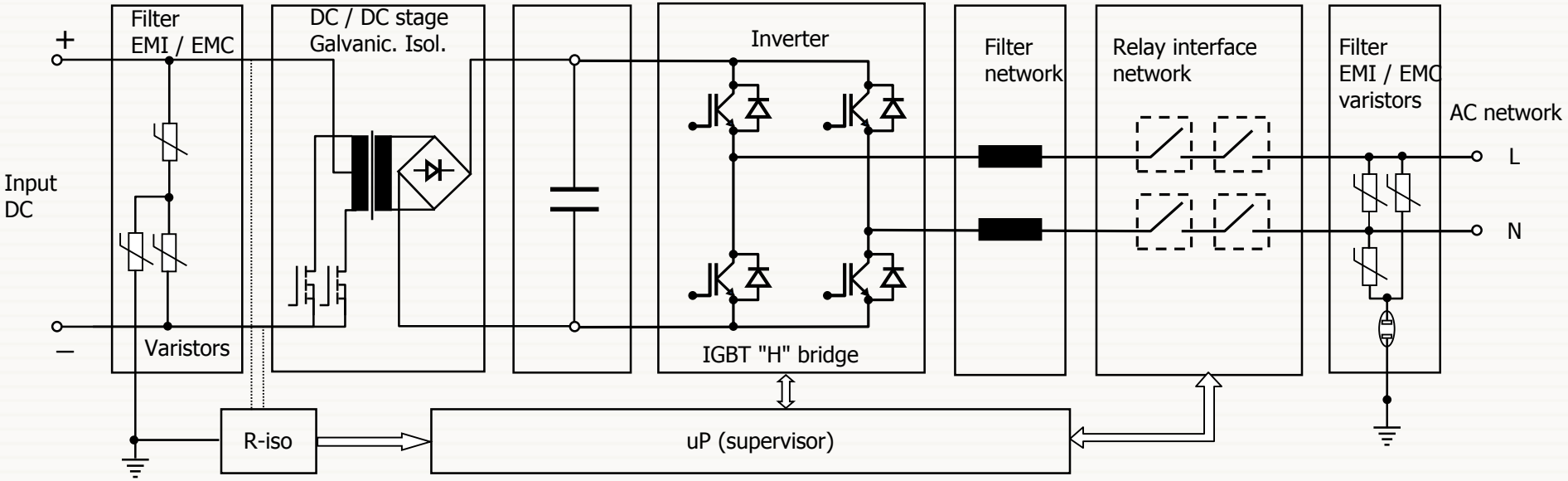
*Automatic adjustment of the working point by means of an **MPPT algorithm***



- What is it used for? To maximize the energy harvested from the photovoltaic field, even in conditions of radiation variables
- How does it work? The inverter find the optimum working point in real time in such a way that the modules always operate in their maximum power point (Maximum Power Point Tracking).

The static conversion system of energy

➔ Type of string inverter: **dual stage insulated with high-frequency transformer conversion**



Inverter with "high-frequency" transformer

- The presence of the "push-pull" DC / DC stage with a high-frequency transformer allows for galvanic isolation with much more contained dimensions and weight than the conventional solution with a 50 Hz transformer.
- The stage of galvanic isolation provides a DC / DC conversion, therefore in order to continuously release components into the network this type of inverter must meet the same requirements and protections as transformerless inverters.
- High-frequency isolation is adopted mainly as a "step-up" function

Energy conversion to alternating current

*Characteristics of inverters "**isolated by a high-frequency transformer**"*

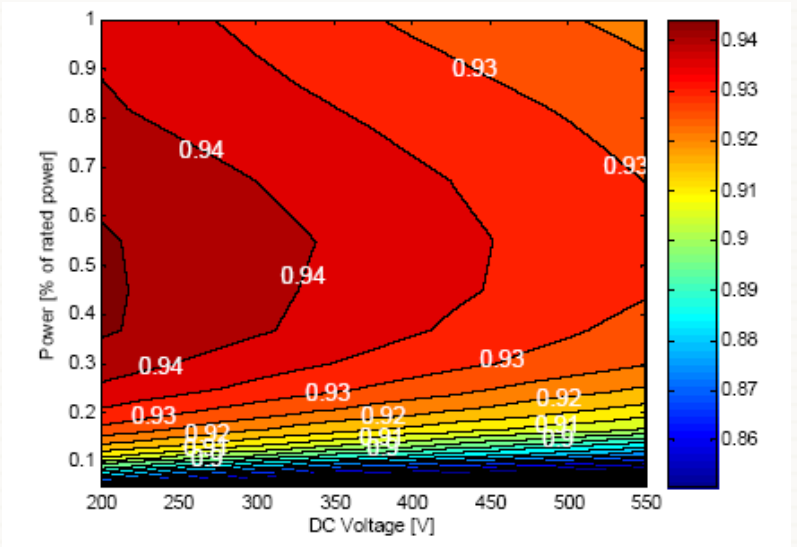
Advantages and limitations of high frequency isolation technology

Advantages:

- Downward extension of working input voltage range to be able to operate below the peak voltage of the grid (intrinsic limit of transformerless single stage of the technology).
- Ability to refer to ground one of the poles of the photovoltaic generator as required for some amorphous or crystalline silicon modules using "all-back contact" technology.

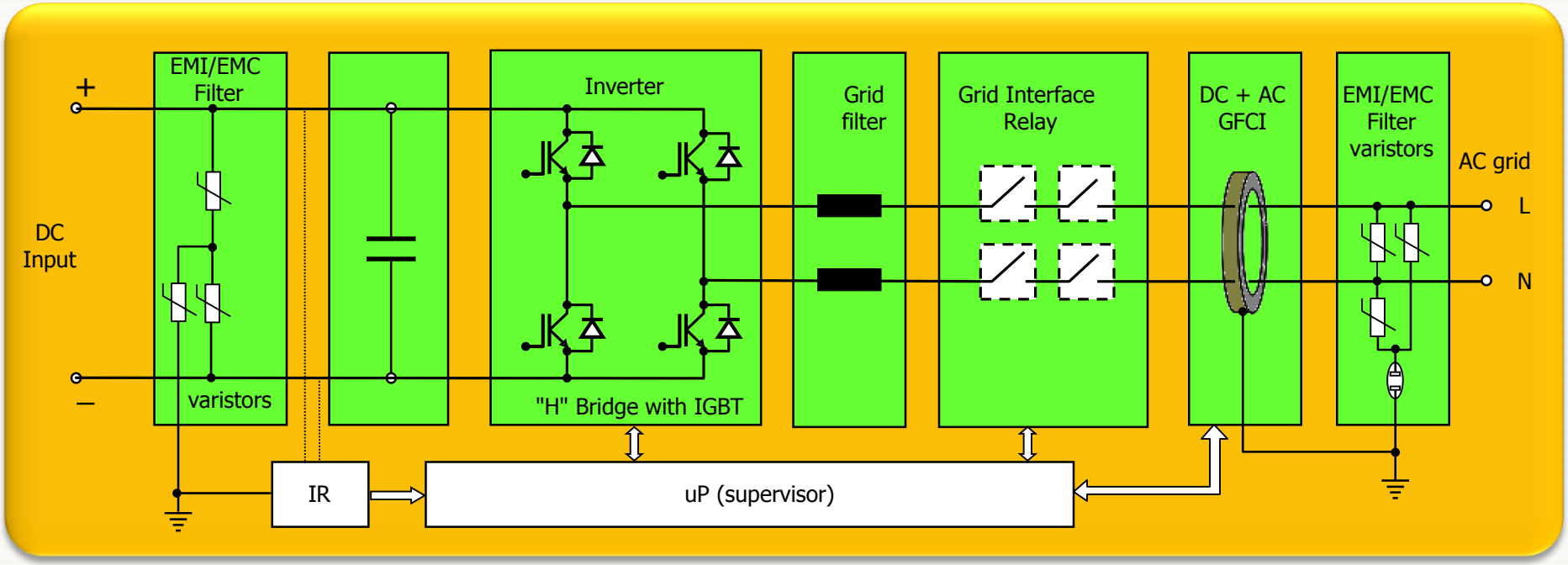
Limitations:

- Efficiency generally lower than that of transformerless systems and centred on the lower limit of the input voltage interval. The DC/DC stage usually works only as a level translator and does not stabilize the working voltage of the inverter, which in turn is penalized when the input voltage increases.
- Voltage interval extended downward, but often limited on the upper end to around 500Vdc. In a trend opposite to the development of modern modules, modules often require numerous strings connected in parallel to limit the Vocmax.



Energy conversion to alternating current

*String inverter topology: ""**Transformerless with single-stage conversion**""*



Transformerless Single-Stage:

- Minimizing losses and higher conversion efficiency
- Lighter weight and more compact size compared to traditional inverters with 50Hz. isolation transformer
- High working frequency, beyond the audible range (> 18kHz), with the additional benefit of the miniaturization of filters.

We are here to dispel a preconception. It is untrue that transformerless inverters are less safe than those having a transformer!

Energy conversion to alternating current

*Characteristics of **transformerless single-stage conversion inverters"***

The "pros" and some limitations of single-stage technology:

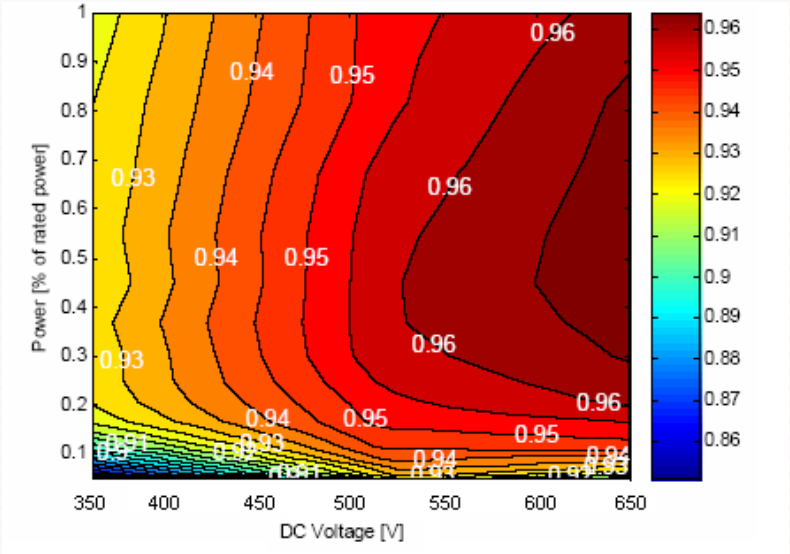
Pros:

- High peak efficiency, combined with relative simplicity of the circuitry.
- Solution very effective if the input voltage range is rather small and particularly complex panels configurations are not required.

Limitations:

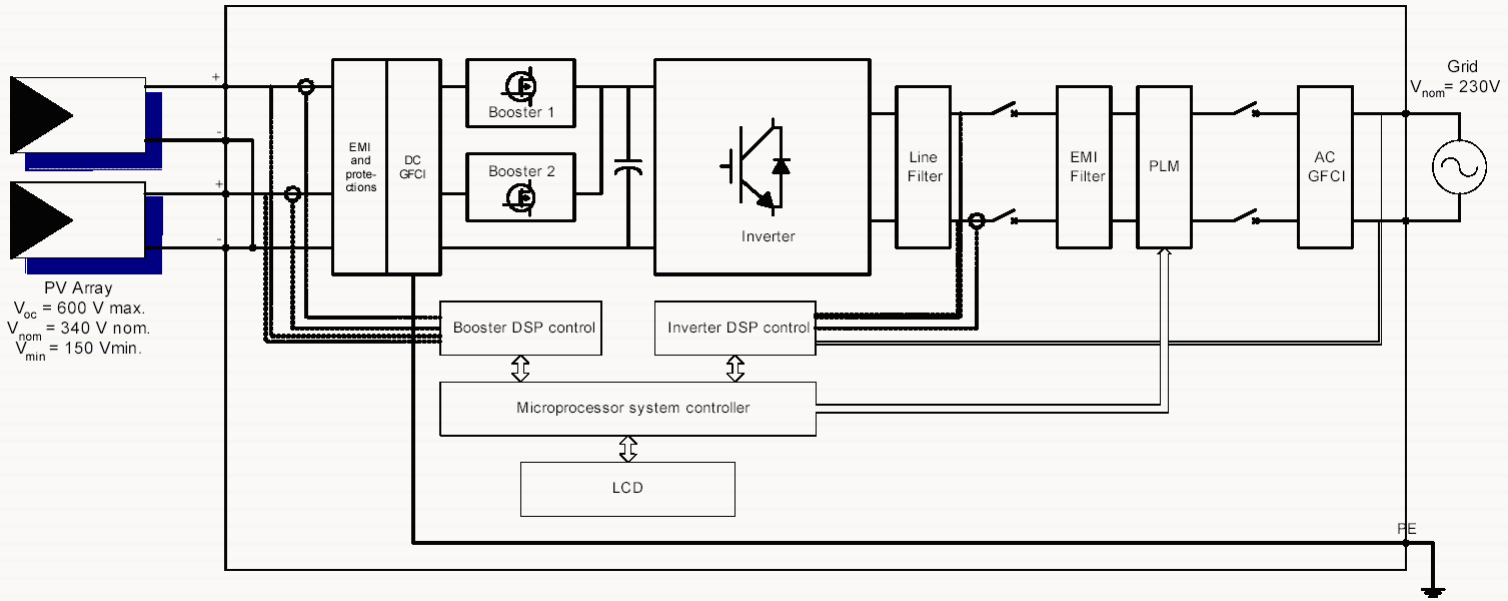
- Range of input voltages limited and shifted "upward". The conversion and grid input is possible only for input voltages higher than the grid peak. Usually the DC range is between 350Vdc and 650/700Vdc for these inverters.

- High efficiency performance peaks, but only available in a narrow voltage range and in some cases "marginal" with respect to voltage variations inflicted on the PV generator by the heating of the cells and changes in radiation.



The static conversion system of energy

➔ Multi-string inverter type: **dual-stage transformerless conversion**



Transformerless with "dual-stage" type:

- Two steps of conversion at high frequency in cascade. The first stage is of DC / DC type, and it is usually given the task of stabilizing the voltage and reaching the maximum power point tracking (MPPT), while the second stage performs the DC / AC conversion to feed power into the grid (usually in an IGBT H-bridge)
- This is the structure used to create the multi-string inverter, by putting the output of 2 DC / DC converters in parallel with the H-bridge input it is possible to create 2 independent channels of maximum power point tracking.

*Characteristics of "**transformerless dual-stage conversion**" inverters*

Advantages and limitations of "dual-stage" transformerless architecture

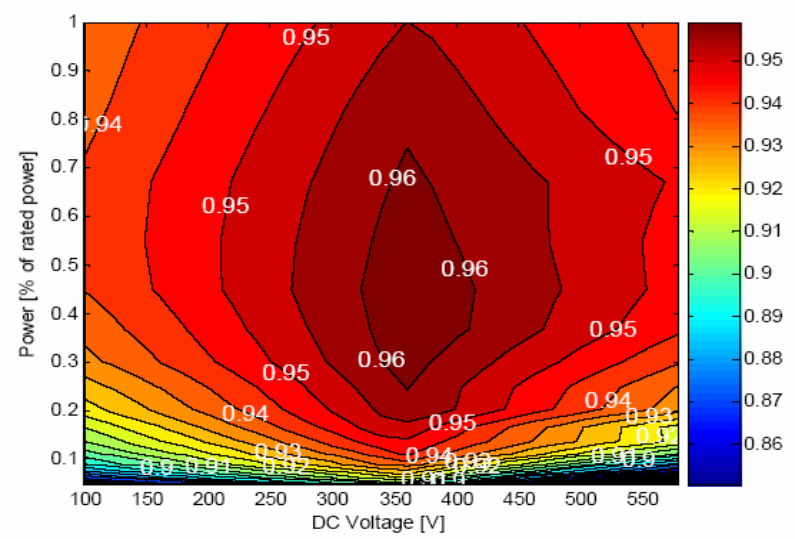
Advantages:

- Input voltage range extremely wide

- Very flat efficiency curves, with performance rather insensitive to operating conditions and input voltage/output current. The inverter always operates at the optimal voltage level to maximize efficiency allowed by the stabilizing action of the DC/DC input converters.

- It is possible to create multiple independent input channels with different installation characteristics (orientation, tild or diferent panels) without compromising the energy output of the system.

- Better yield with multiple MPPT



Note:

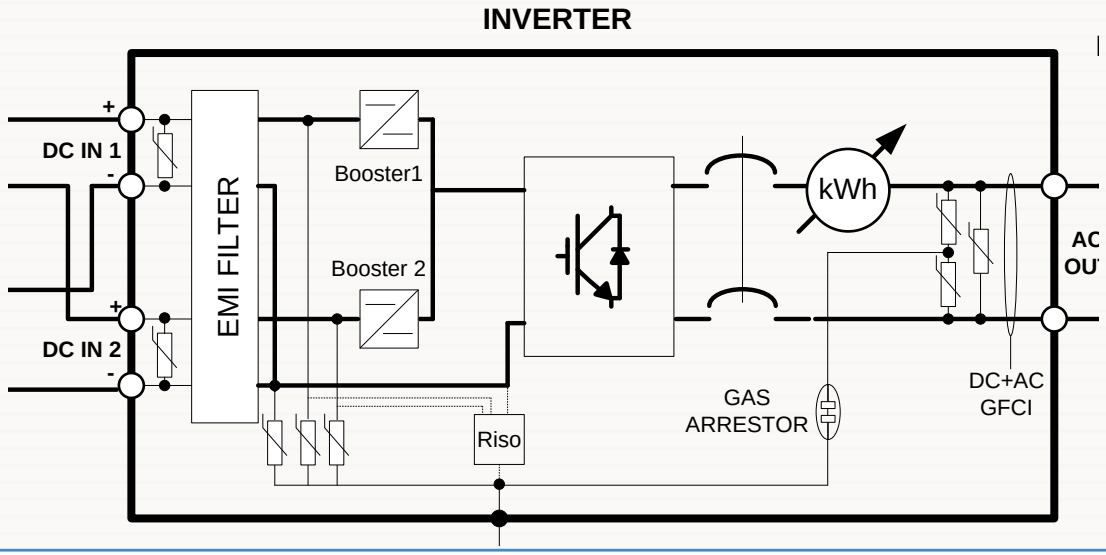
Though the cost per kWp of these inverters is theoretically higher than that of single-stage systems, the higher energy output achieved makes it possible to recover any increased costs in a few years!

Topology 1-Phase string inverters

Transformerless Technology Minimizing losses and increasing conversion efficiency.

Other adventages of “Dual Stage” topology:

- The inverter always operates in maximal efficiency region
- Extrem wide input voltage range combined with flat efficiency curve
- Array can be split in 2 independent subarrays each with stand-alone maximum power point tracking.



Confidential

power-one® A MEMBER OF THE ABB GROUP

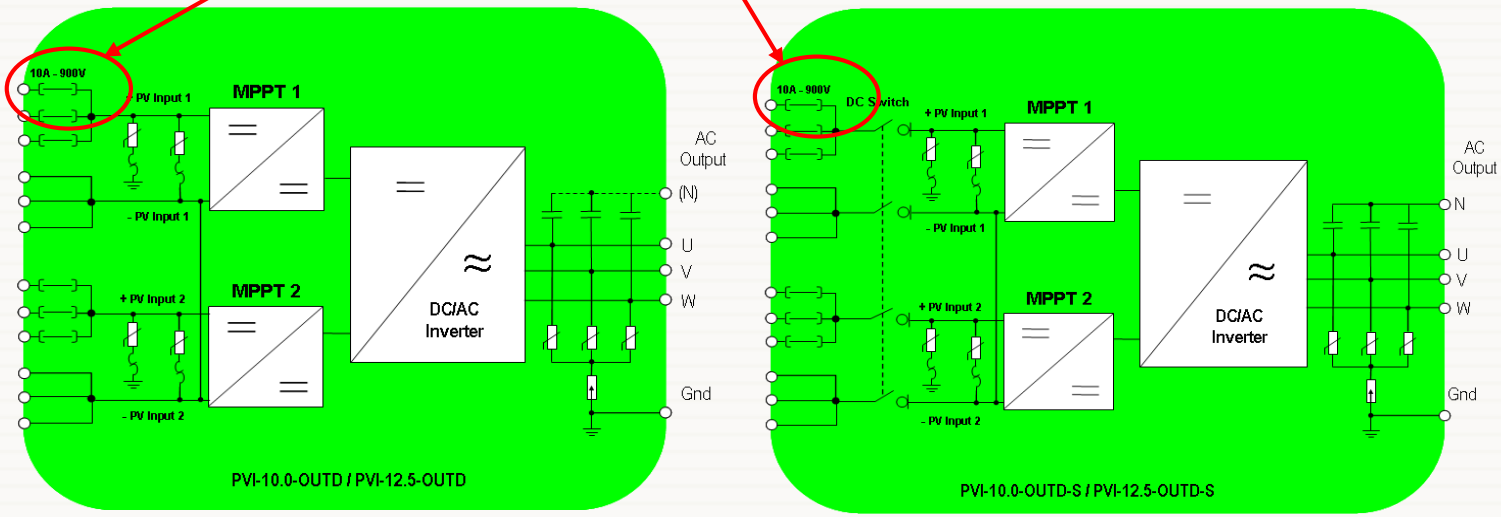
Topology 3-Phase string inverters

- True 3-phase bridge topology for DC/AC output converter (not 3 x single-phase inverters in one package!!)

- Each MPPT input includes standard MultiContact® MC4 connection for 3 strings

- Available with optional integrated DC switch and fused inputs, to complete the DC protection system for large plants without extra-costs or external components

12A max. per connection pair! Allowed increase up to 20A .



Confidential

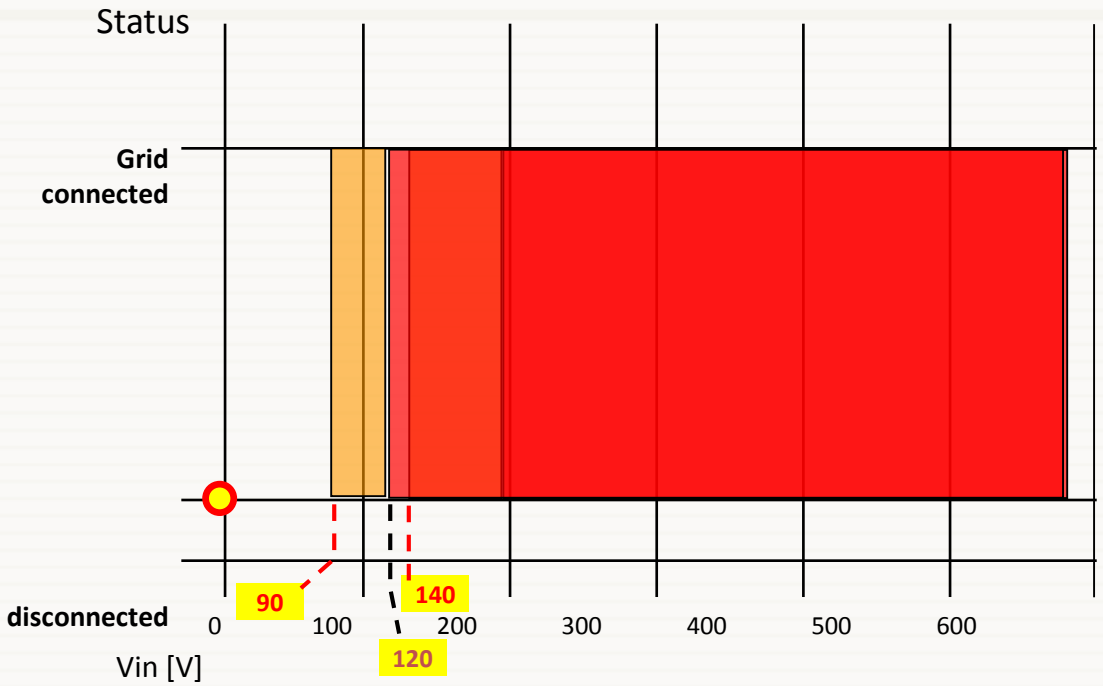
power-one® A MEMBER OF THE ABB GROUP

AURORA® PVI-3.0/3.6/4.2-TL-OUTD & PVI-5000/6000-OUTD

String Inverters 3kW - 6kW – Single phase	***PVI-3.0-TL-OUTD***	***PVI-3.6-TL-OUTD***	***PVI-4.2-TL-OUTD***	***PVI-5000-OUTD***	***PVI-6000-OUTD***
Input parametrs (DC Side)					
Rated DC Power [kW]	3.12	3.75	4.38	5.15	6.18
Maximal recommended DC Power [kW]	3.5	4.15	4.82	5.3	6.4
Input voltage range [V]	0.7x VStart to 580 (360 rated)				
Full power MPP range [V]	160-530	120-530	140-530	140-530	170-530
Full asymm. Operation MPP range	200-530 @2kW	190-530 @3kW	190-530 @3kW	220-530 @ 4kW	220-530 @ 4kW
Max. Input Voltage [V]	600				
Input Activation Voltagan VStart [V]	200 rated (adjustable 120-350 via Software and Display)				
Number of independent MPP inputs	2	2	2	2	2
Maximal Input Power per MPPT [kW]	2	3	3	4	4
Number of DC Inputs(Connection pairs)	2 (1 per MPPT)	2 (1 per MPPT)	3 (2 on MPPT 1 1 on MPPT 2)	4 (2 per MPPT)	4 (2 per MPPT)
Maximal Input Current per MPPT [A]	10 (12.5)	16 (20)	16 (20)	18 (22)	18 (22)
DC Varistor	4 (2 per MPPT)				
DC Switch	Integrated (600Vdc/25A)				

Confidential

Input activation voltage-Start voltage



Vstart:

Default:
- 200V for Single phase inverters
  Adjustable: 120V-350V
- 360V for Three phase inverters
  Adjstable: 250V-500V

Disconnection: at 70% VStart

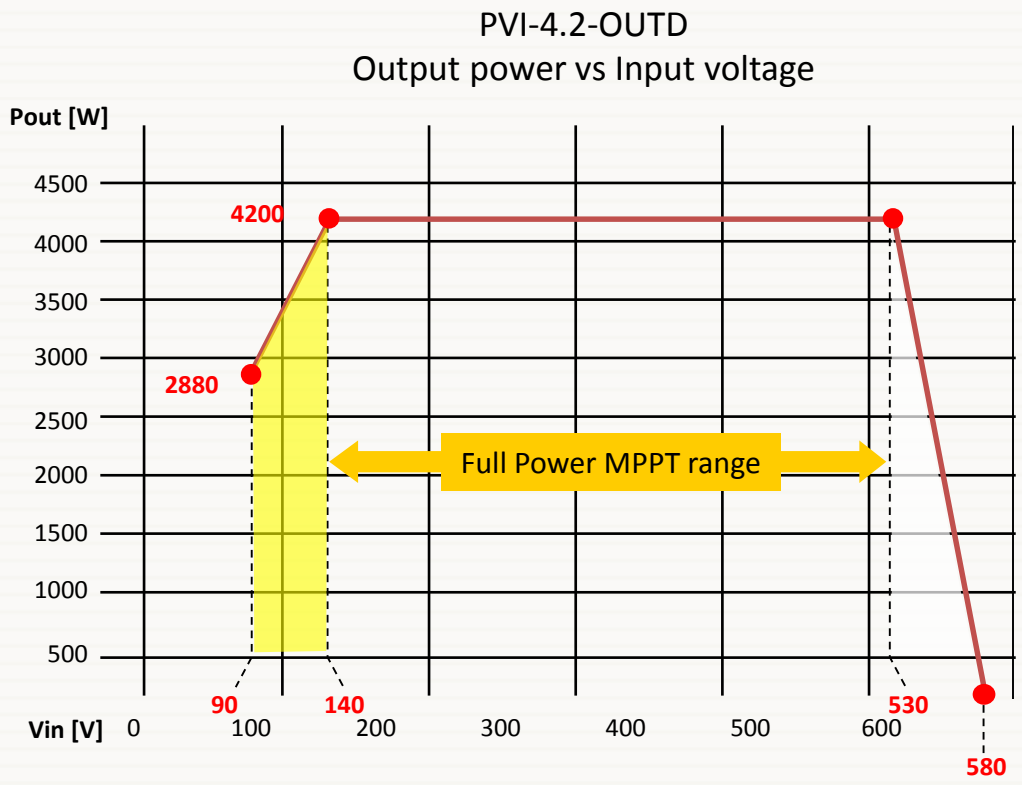
Easy adjustable via Display!!

- Input activation voltage "Vstart" is the input voltage when the grid connection starts!.
- Vstart can be adjusted independent for each MPP-input (Vstart1 & Vstart2)
- After start sequence the inverter stays grid connected till the grid voltge went down under 70% of Vstart
- Maximal Flexibility in fitting of PV-Array disposition -> Reduction of undesirable grid connection and disconnections.

Confidential

Power Derating vs Input voltage

Power derating as a function of input voltage - **Full Power MPPT Range**



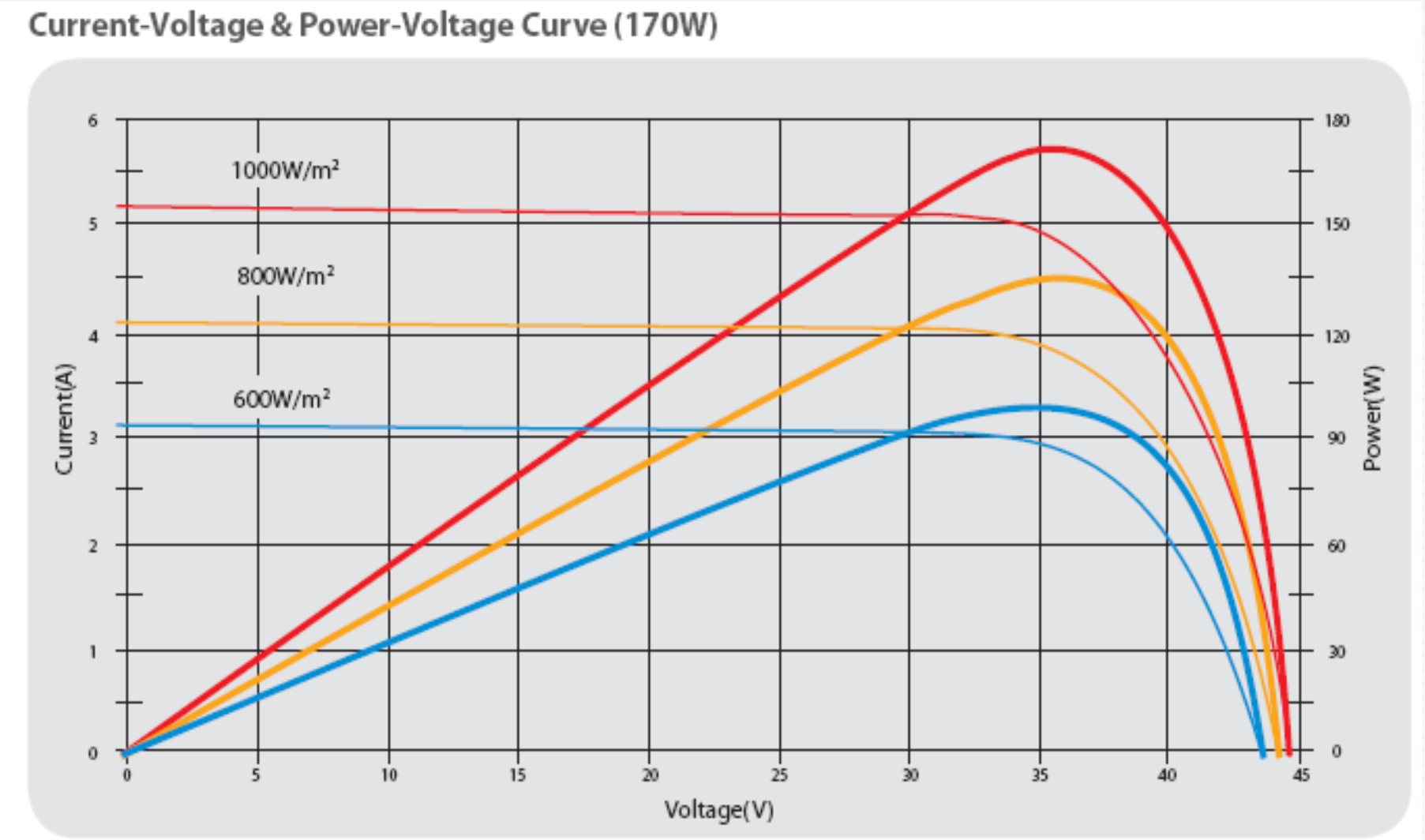
Power derating at lower input voltage caused by limited current

Linear power derating over 530Vdc (full power limit) to 580Vdc (disconnect) to avoid excessive overloading of Power transistors (IGBT)

Example shows the inverter with symmetrical load

Confidential
power-one® A MEMBER OF THE ABB GROUP

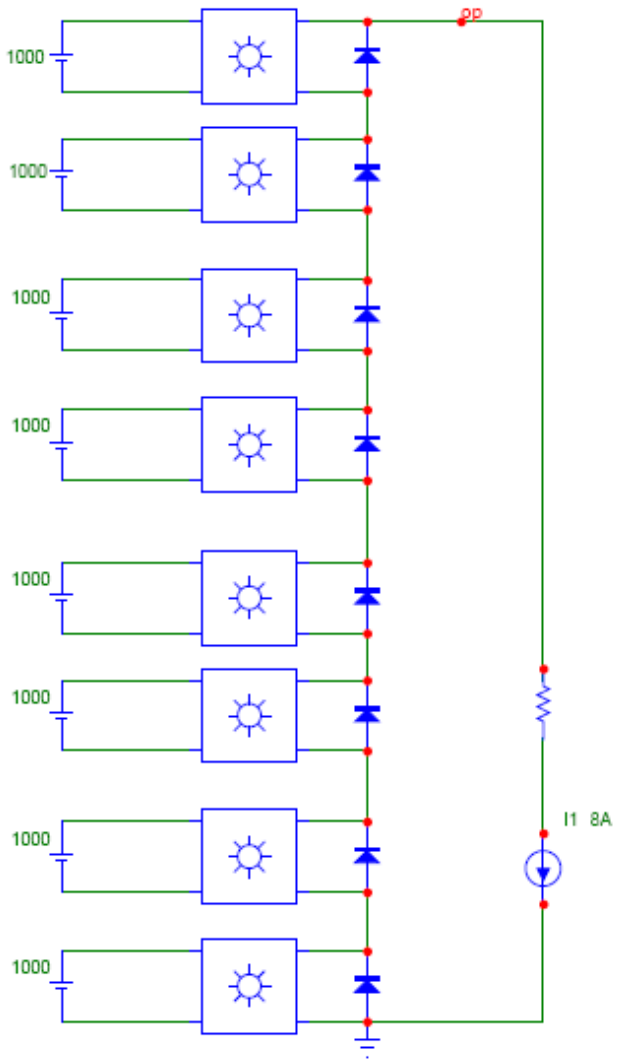
The problem of shading

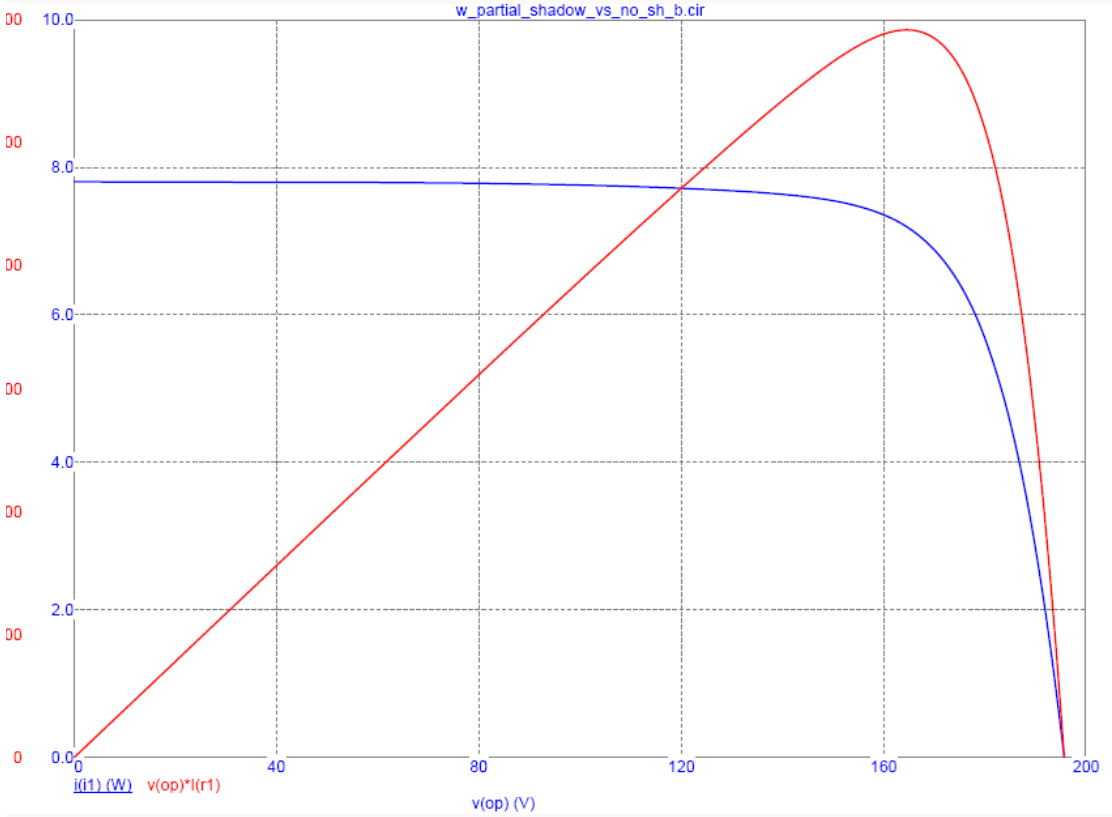


Confidential

power-one® A MEMBER OF THE ABB GROUP

The problem of shading

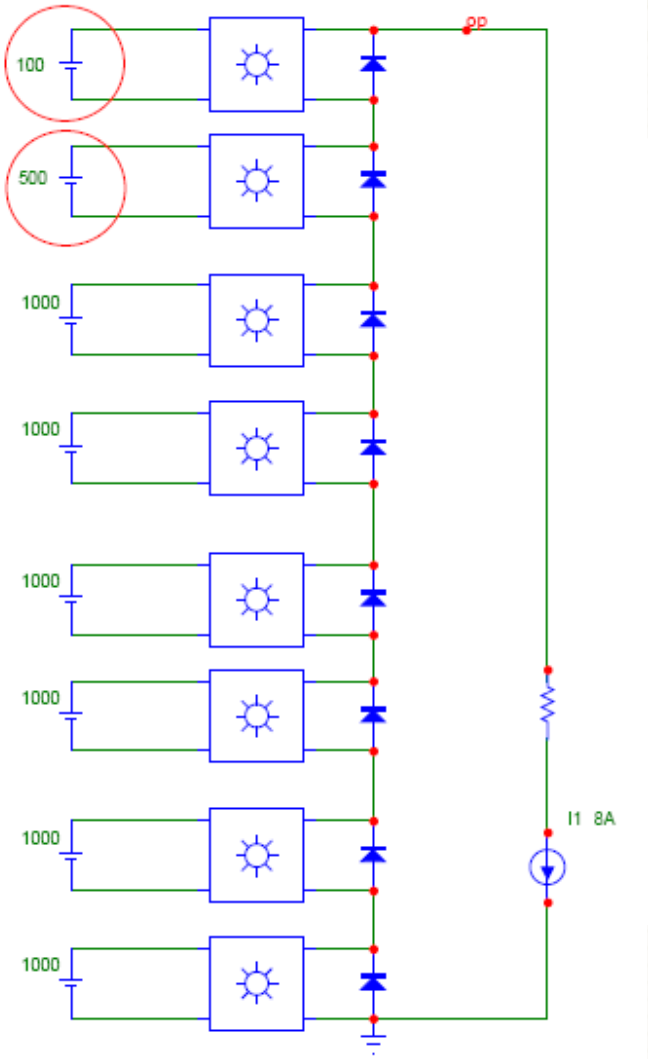


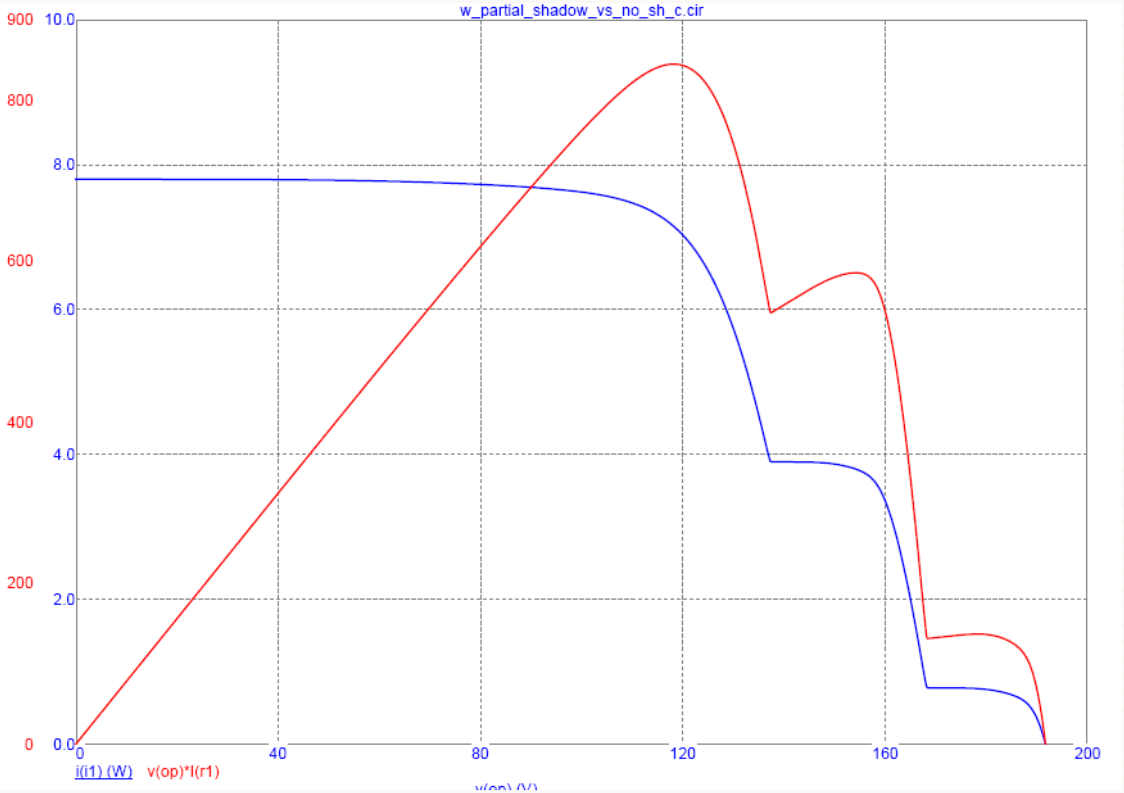


Confidential

power-one® A MEMBER OF THE ABB GROUP

The problem of shading



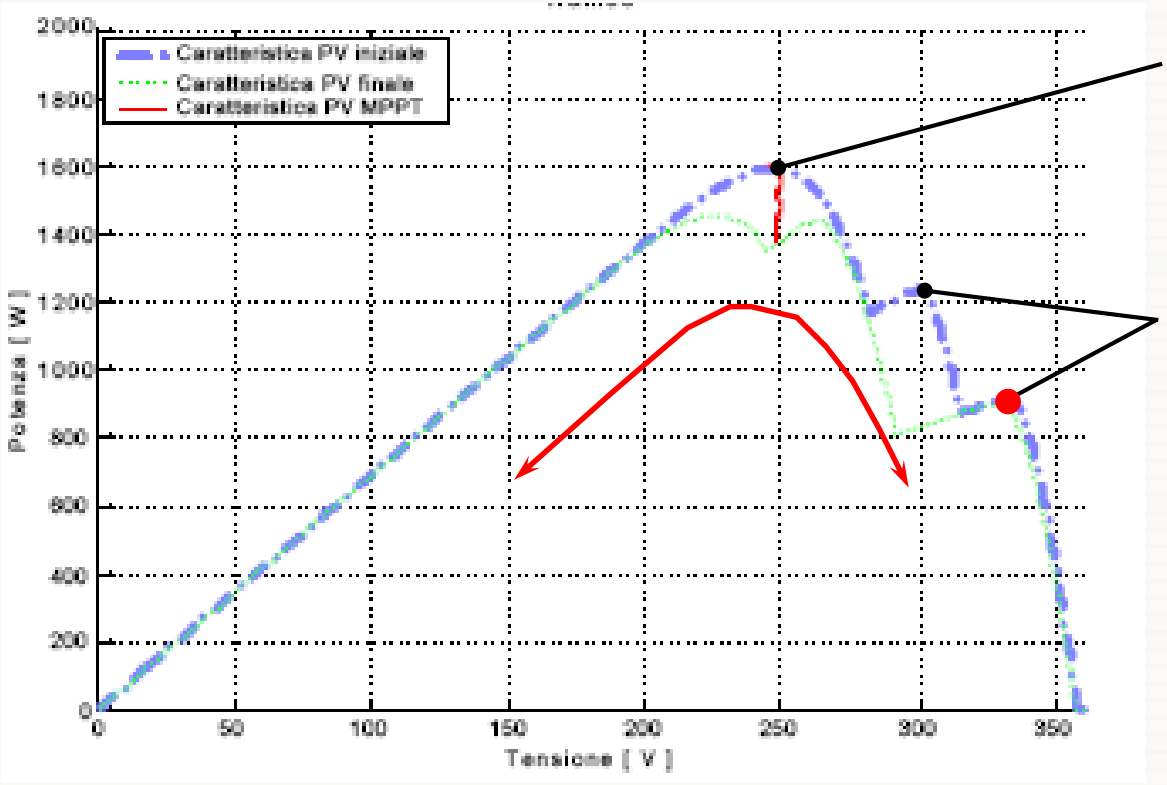


Confidential

power-one® A MEMBER OF THE ABB GROUP

MPP-Scan Function

- *Periodic "MPPT scan" function* , to intercept and track the "absolute maximum" of the power curve among pultiple "relative maximum" points, under partial shading conditions of the PV array.



"Absolute"

Maximum

"Relative"

Maximal power points

Confidential

power-one® A MEMBER OF THE ABB GROUP

AURORA® PVI-3.0/3.6/4.2-TL-OUTD & PVI-5000/6000-OUTD

String inverters 3-6–6kW Single phase	*PVI-3.0-TL-OUTD*	*PVI-3.6-TL-OUTD*	*PVI-4.2-TL-OUTD*	*PVI-5000-OUTD*	*PVI-6000-OUTD*
Output (AC Side)					
Rated AC power [kW]	3	3.6	4.2	4.6	6.0
Maximal AC power [kW]	3.3*	3.96*	4.6*	5.0	6.0
Grid connection	single phase				
Rated AC voltage [V]	230				
Maximal AC Voltage Range [V]	187.2-224.6 (208 Vr) / 216-259.2 (240 Vr) / 249.3-299.2 (277 Vr)				
Maximal AC Current (Imax) [A]	14,5	17,2	20	22	30
Short Circuit Current	16	19	22	30	30
Rated Grid Fequency [Hz]	50				
AC Varistor	2 (Live - Neutral / Live - PE)				
Rated Power Factor cos(φ)	1 (adjustable ±0.9)				
Total Current Harmonic Distortion (THD)	<3.5% at Rated power and Sinusoidal voltage			<2%	
Maximal Efficiency	96.8%			97%	
Euro Efficiency (CEC)	96%			96,5%	
Standby Cosumption	8				
Feed in Power Treshold [W]	20				
Night Time Power loss [W]	< 2				
Isolation	No (Transformerless)				

*** In Germany limited to 3.0, 3.6 resp. 4.2 kW**

Confidential

power-one® A MEMBER OF THE ABB GROUP

Stand-by operation

- Input voltage dropped under minimal input voltage (70% Vstart):

  - Inverter stays a definded time connected to grid:
    UV-Protection time. During this time inverter consumes energy from grid!!
    (Standby consumption according to datasheet : <20W)

- UV-Protection time is adjustable 1s - 3600s

Advantages:

- Inverter doesn't need undergo hindering activation procedure
- Higher profit eventhough short time Energy consumption from grid

Confidential

Program

Company presentation

Product overview and technical data

Topology and functions

Installation

Commisioning and operation

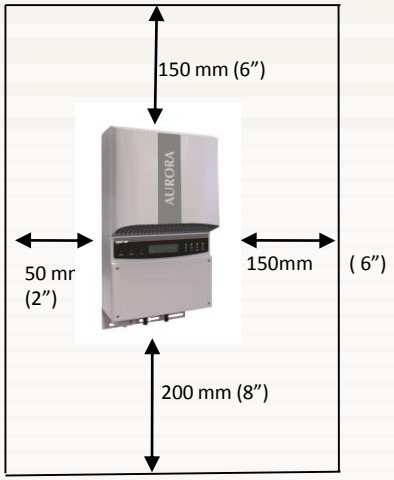
Communication and monitoring

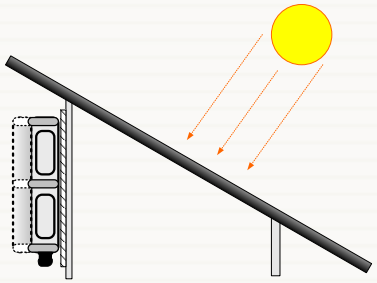
Correct sizing with Aurora Designer or Stringsizer

power-one®
A MEMBER OF THE ABB GROUP

Installation

Adhere distances (see the manual)
-Side: USB and programming interfaces
- Top: heat dissipation
- Below: Access to the connectors
- All sides: Mutual heating from multiple inverters





- No expose to direct sunlight

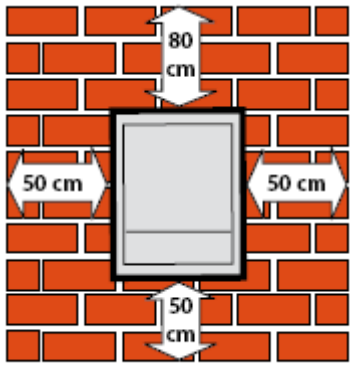
- Heat dissipation does not affect!

Not on inclined surfaces mount (derating from 5 degrees inclination)

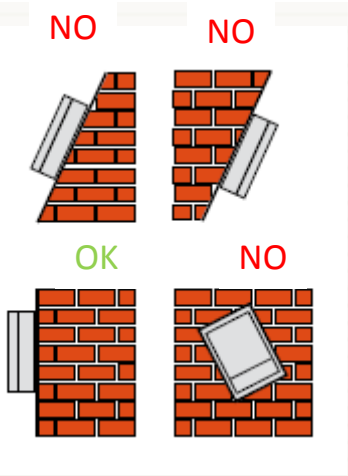
Confidential

Installation (1)

Adhere distances (see the manual)
-Side: USB and programming interfaces
- Top: heat dissipation
- Below: Access to the connectors
- All sides: Mutual heating from multiple inverters



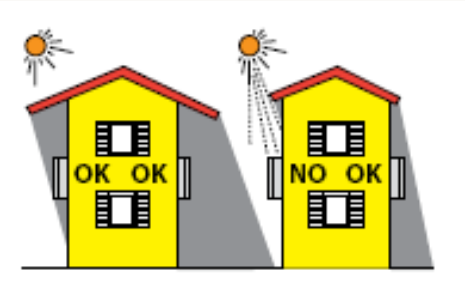
Do not mount on inclined surfaces
(derating from 5 degrees inclination)



Confidential
power-one® A MEMBER OF THE ABB GROUP

Installation (2)

- Do not expose to direct sunlight!



Do not interfere heat dissipation!

NO

OK

OK

Confidential

power-one® A MEMBER OF THE ABB GROUP

Installation

GOOD!

POSITION: Well ventilated protection: From direct sunlight by PV panels or metal frame

Accessibility:
Sideways (3.6 kW)

BAD!

Accessibility:
No access from the side!

Confidential

power-one® A MEMBER OF THE ABB GROUP

Installation

GOOD!

Thermal:

Protected from direct sunlight

No thermal mutual influence? Inverter

BAD!

Accessibility

No access from the side!

GOOD!

No accessibility !

Confidential

power-one® A MEMBER OF THE ABB GROUP

Installation

BAD!

THERMAL LAYOUT

The heat produced by the lower inverter increases the ambient temperature of the upper inverter!

recommendation:
Inverter can not order directly over each other!

Confidential

power-one®
A MEMBER OF THE ABB GROUP

Installation and Configuration Accessories

Mounting plate
CD with communication software
Operating and Installation Manual

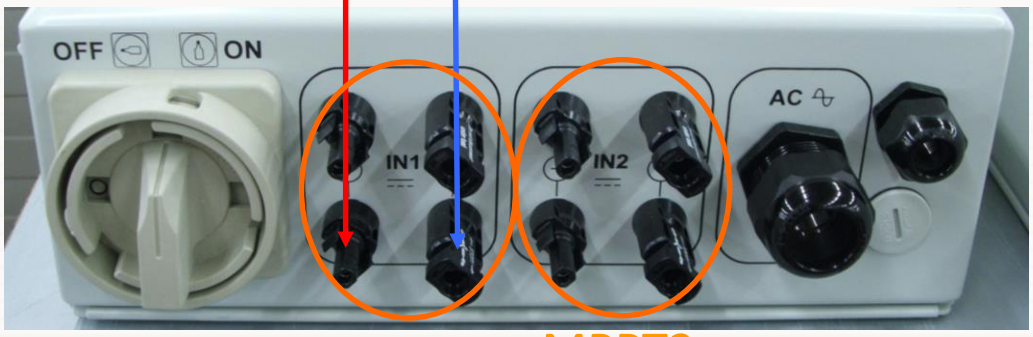
Complete installation kit:

- Multi Contact connectors
- Cable Glands (AC / communication)
- Jumpers prepared for the input configuration
- Tool (Torx and bent screwdriver)

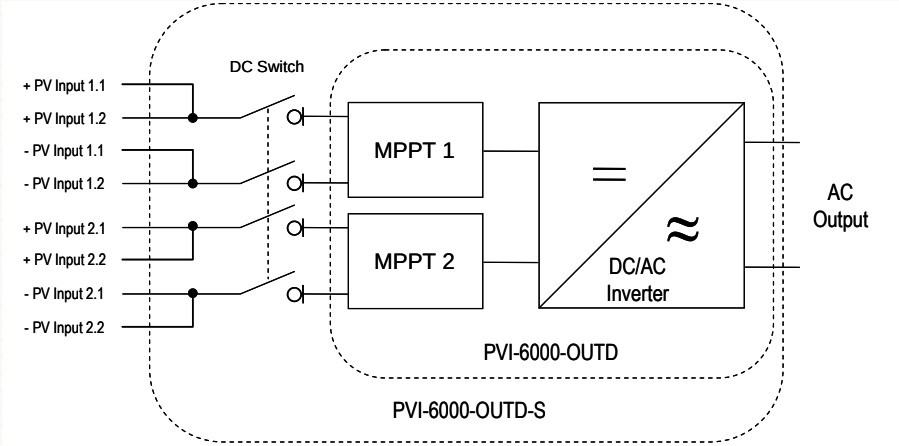
Confidential

DC Connection

+ Pol - Pol



MPPT1 MPPT2

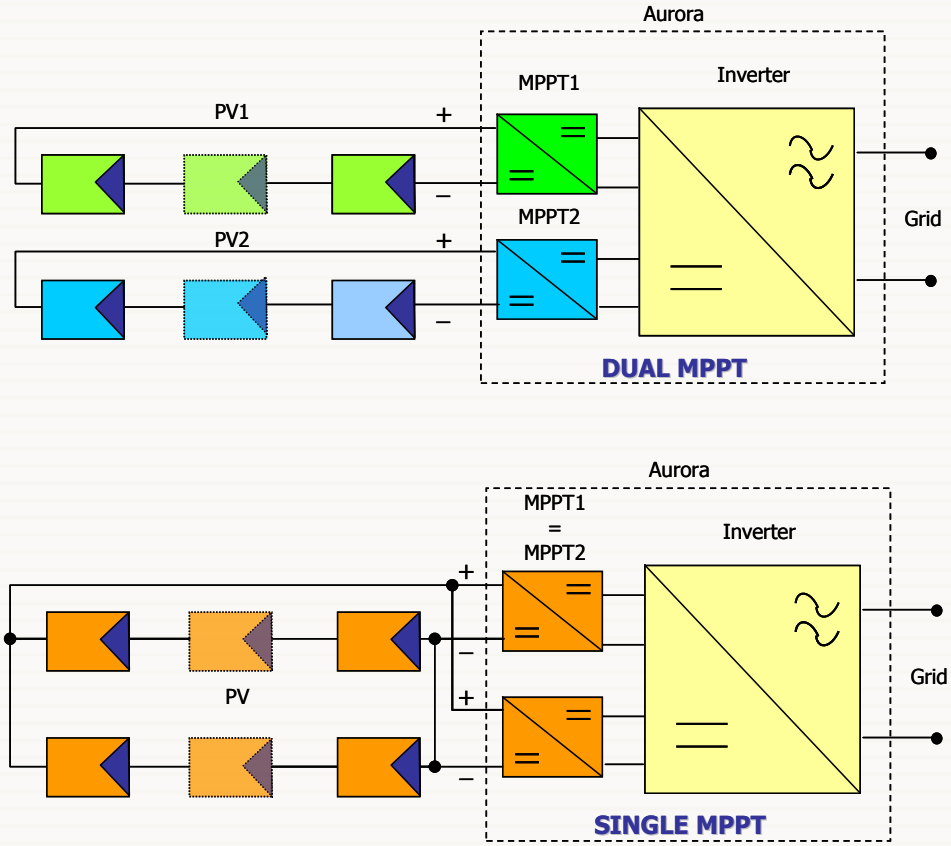


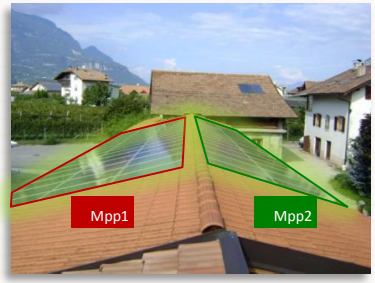
„Connection box" integrated in the inverter!

Confidential
power-one® A MEMBER OF THE ABB GROUP

Independent or parallel operation?

Selection of Input configuration – **dual or single MPPT ??**



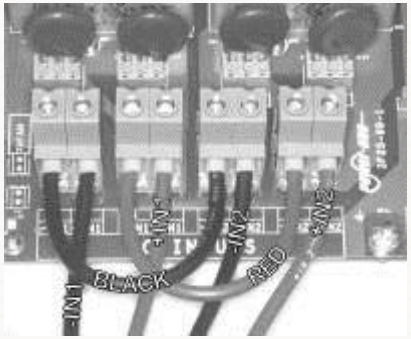


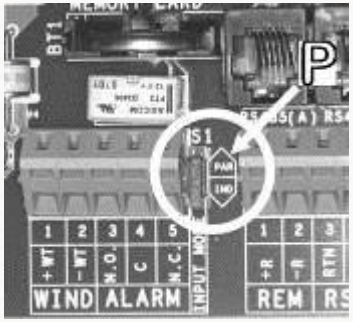
Parallel connection is very easy (no PC necessary); set up available from front side

Confidential

power-one® A MEMBER OF THE ABB GROUP

Independent or parallel operation?





Parallel connection is very easy (no PC necessary); set up available from front side)

Dual MPPT :

- Panels with different orientation or partial shading
- Uneven number of panels and even number of strings
- Different type of panels

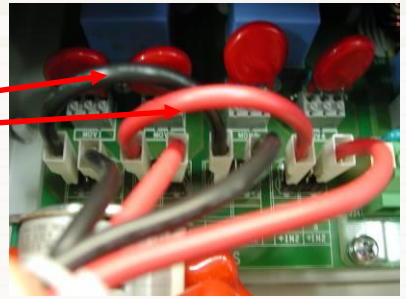
Single (parallel) MPPT:

- One string or array exceeds current/power of one input
- Uniform array due to cost saving reasons only one cable can be laid

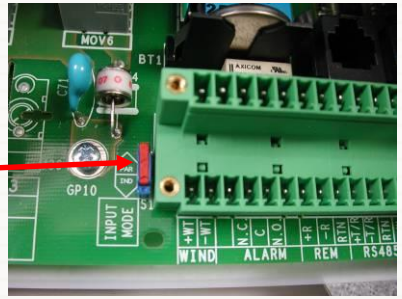
Confidential

DC Connection

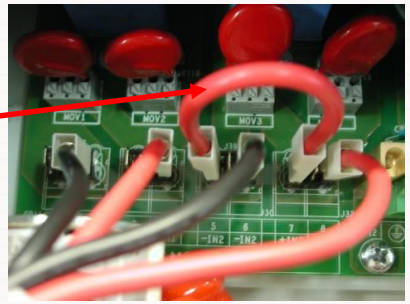
Jumpers in parallel operation



Miniature switches for MPP mode
(status is after a restart activated!)



Jumper (from unused input avoid incorrect measurements at the open input)



Confidential

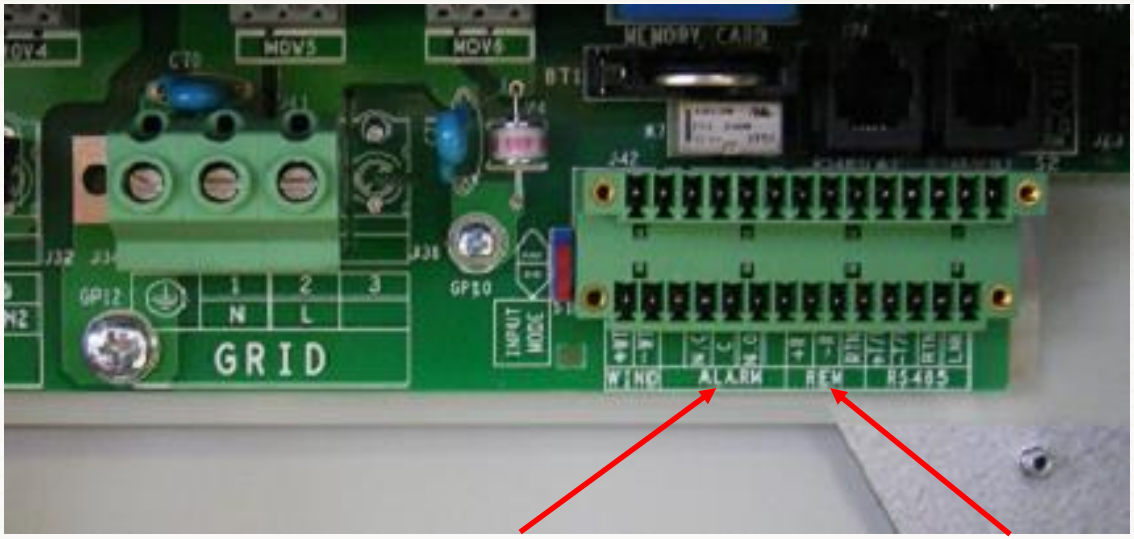
AC and Communication

AC Connection:
Screwed or clamped
Observe Nationale regulations!!

RS 485 Communication:
TR+, TR- and Gnd
Connector is supplied

Confidential

Remote Input and alarm output



Alarm: The NC (n.c) a normally open (n.o). Rating: 2A 230VAC max!
The alarm contact has 2 functions adjustable via display!
- Production: contact closes when inverter connected to the grid. Fault: contact closes by an error or if the inverter disconnects from the grid, but not at low voltage at the input (little light)

„Remote Control“:
Short circuiting contacts: Inverter shutdown!
CAUTION: Do not feed external voltage!

Confidential

Program

Company presentation

Product overview and technical data

Topology and functions

Installation

Commisioning and operation

Communication and monitoring

Correct sizing with Aurora Designer or Stringsizer

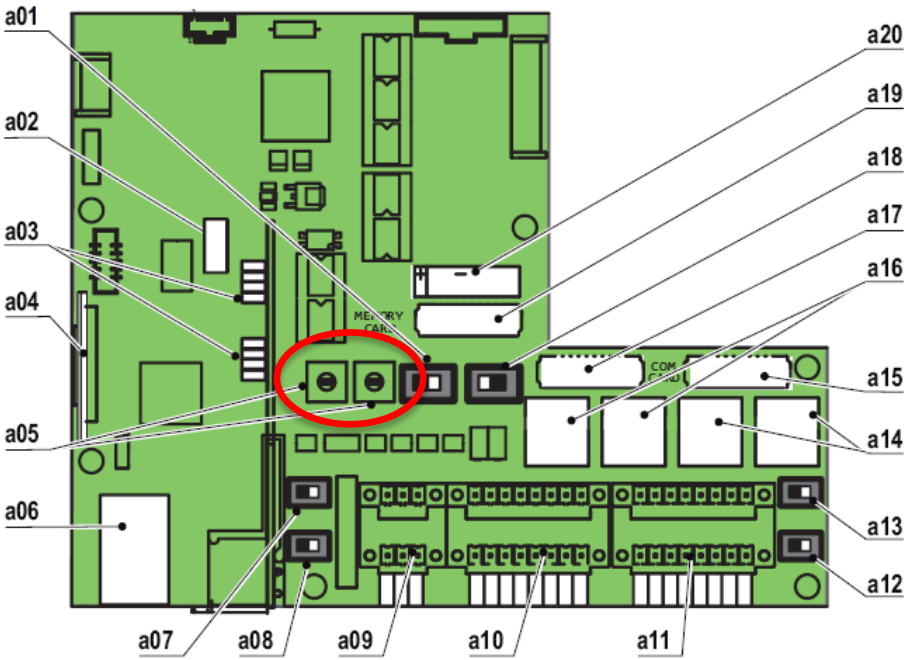
Before starting up

- Check Open circuit voltage at the input!
- Check Input Polarity !
- Measure PV Field Insulation resistance (if possible)
- Check phase sequence of 3-phase devices and phase-neutral of single phase devices
- Check MPP mode
- Make regional settings (For models with rotary switch)

Confidential

Country- and language settings(1)

TRIO-20.0/27.6 settings



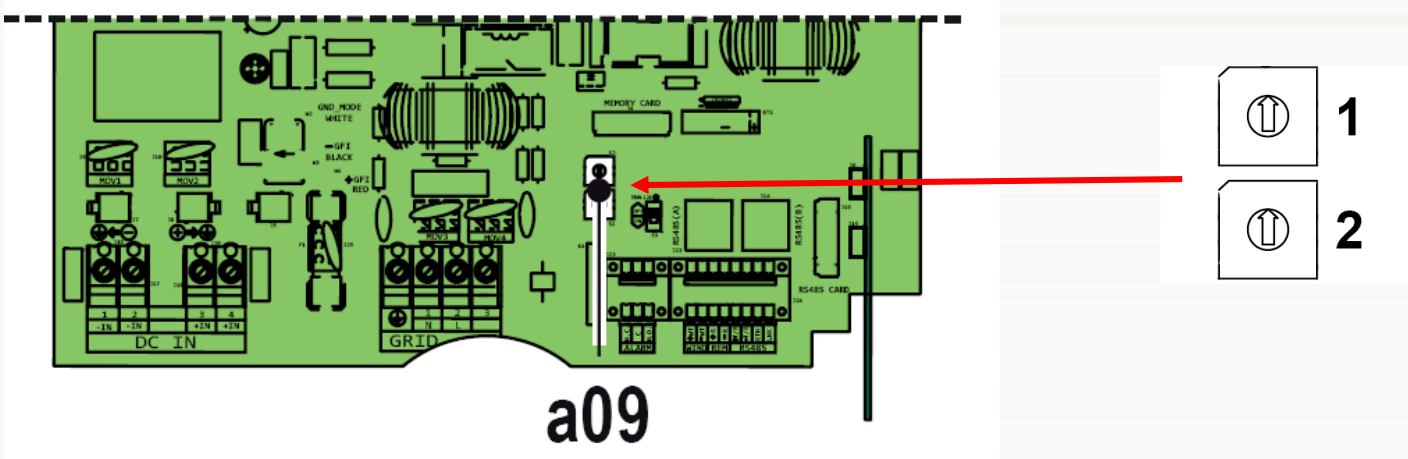
Switch left	Switch right	Grid code	Language
0	1	VDE-126-1-1	German
0	C	BDEW	German
1	7	VDE-AR-N 4105	German

Country and language settings with rotary switch a05.
Further adjustments according to manual

Confidential

Country- and language settings (2)

UNO-2.0/2.5-I settings



Switch 1	Switch 2	Grid code	Language
0	1	VDE-126-1-1	German
1	7	VDE-AR-N 4105	German

Country and language settings with rotary switch a09.
Further adjustments according to manual

Note:
For some devices, the country must be set AFTER the startup via the display:? UNO-3.0/3.6/4.2

Confidential

Start up sequence

- **Step 1**: DC Switch turn on
- **Step 2**: AC connecting

Inverter behavior:

- **Case 1: DC voltage between 100V (200V) and VStart up;** Input power> ca. 8W
  -> Inverter starts up display: waiting for Sun…
  -> Green LED „Power“ flashes“

- **Case 2: DC voltage > Start up voltage** (200V/360V default)
  -> Inverter starts checking of grid parameters (Voltage, Frequency) and measures the Insulation resistance Riso. Green LED flashes
  -> Inverter performs the internal self-test
  -> This process takes about 30 ... 60 seconds. The measured values are displayed on the screen. The green LED flashes.
  -> If are all parameters in order the inverter connects to the power and feeds Energy to the grid. The green LED is lit. Accumulated energy and other values are displayed

After startup:
Set time and date!
Countries setting check
In case of more inverters monitoring, set individual address for each one inverter.

Confidential

Menu structure: Main Menu

Graphic display :

2-line display :

Built in:
- UNO-2.0/2.5-I
- TRIO-20.0/27.6

Built in:
- UNO-3.0/3.6/4.2
- PVI-10.0/12.5-(I)

The menu structure in the graphical display corresponds to the 2-line display

Confidential

Menu structure: Main Menu

Type and part number	Type OUTD PN----------
Serial number and Firmware Version	S/N--------- xxxxxx FW rel. C.0.1.1
Daily energy and daily income	E-tod 0 Wh $-tod 0.0 EUR
Total energy and total income	E-tot ---------- E-par 0 KWh EUR
Output power, Inv. temperature	P-out 0 W T-inv - °C
Peak power overall, Today	Ppk W Ppk Day ……..W
Grid voltage current, average	Vgrid 197 V Vgrid Avg 0 V
Grid current, frequency	Igrid 0.8 A Fgrid 50.18 Hz
Input voltage, - Current 1	Vin1 0 V I in1 0.0 A
Input voltage, - Current 2	Vin2 0 V I in2 0.0 A
Input power 1 and 2	Pin 1 0 W Pin 2 0 W
Measured Riso and actual leakage current	Riso 0.0 Mohm Ileak 73 mA
Status and Date	Inverter OK Wed 17 May 11 23

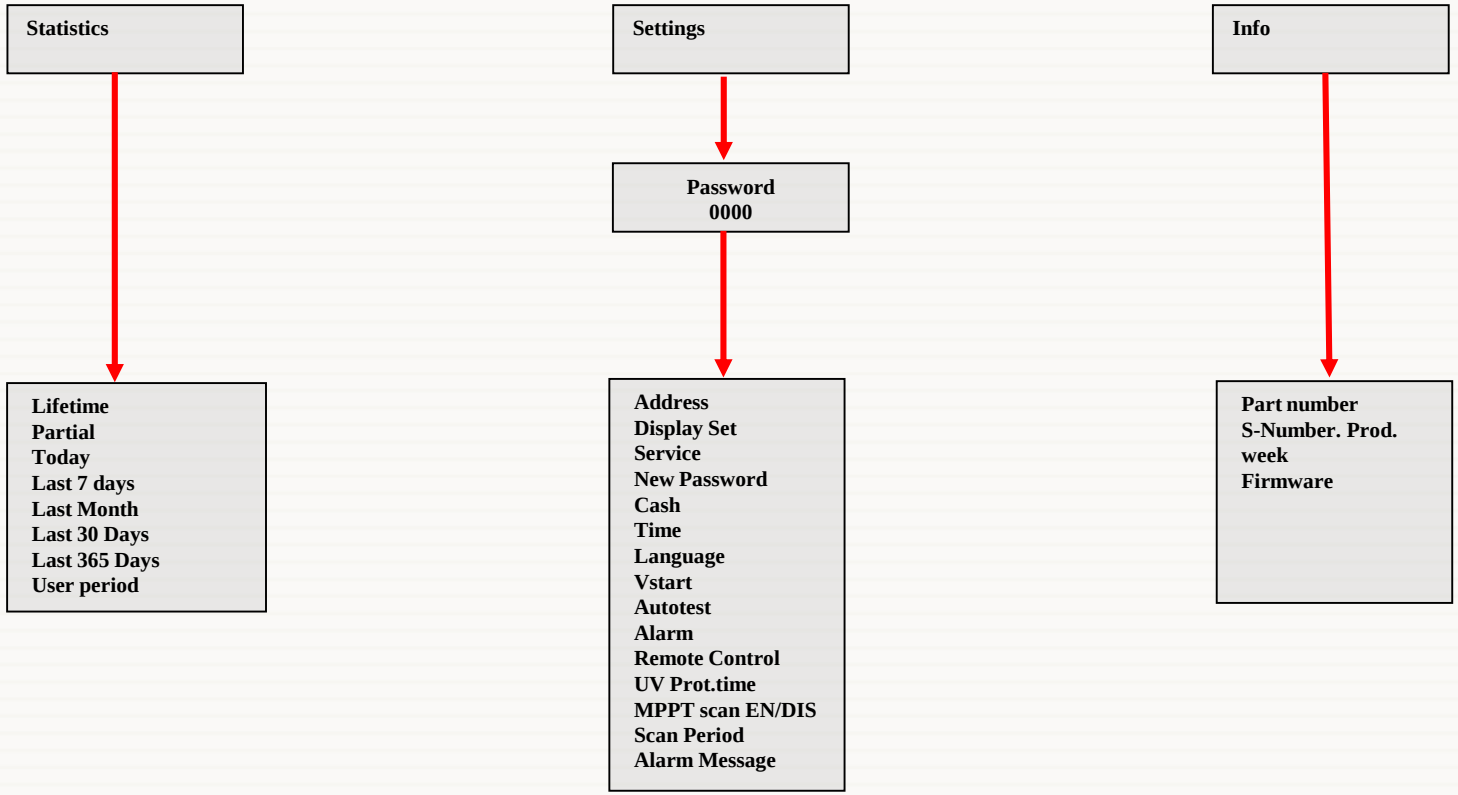
„Autorotate“

Enter-button

Blocked at a value

Menu structure: Submenus

Pressing the **"ESC"** button in the main menu takes you to the sub-menus



Note: Resetting of Partialcounters: Enter button press for more than 3 seconds!

Confidential

Menu structure: submenu settings(1)

Passwort: 0000

- Address: RS485 address setting
- Display: Contrast, Backlight, Buzzer
- Service: Only for Power-One
- New Password
- Cash: Sets the sum / KWh
- Time: clock setting
- Language: English and local language
- VStart: startup voltage setting
- Alarm: Set the alarm function (Production or Fault)
- Remote control: Remote control,
- UV Prot.time: connection time at input voltage fall bellow the minimum Input voltage. -> Standby mode!
- MPP-scan EN/DIS -> not implemented on all models!
- Scan Period: Time interval of MPP scans
- Alarm Message: create your own alarm
- Active power limitation (not the PVI-10.0/12.5)
- Reactive power settings (not the PVI-10.0/12.5)

Confidential

Menu structure: submenu settings

Additional settings *

- Reactive power
  - No adjustment
  - cos(phi) fix
  - tan(phi) fix
  - cos(phi)) f(p)
  - Q=f(U)
- Power limitation
  - Enter value
- Analog inputs (TRIO-20.0/27.6)
  - Gain (Slope of the curve)
  - Offset
  - Unit
  - PT 100
  - PT 1000

* Not all settings are available on all devices!

Confidential

Meaninig of 3 LEDs

Status of LED	Function	Description
Green: Yellow: Red:	Night mode	
Green: F Yellow: Red:	Start up mode	
Green: Yellow: Red:	Normall operation	
Green: x Yellow: x Red:	Isolations failure	
Green: Yellow: Red:	Warning / Failure	
Green: F Yellow: Red:	Failure: Missing Grid	

Confidential

Fault – what now?

- Fault is indicated: Yellow LED lights

- The parameters which constantly triggered the fault check again

- The fault disappears, the inverter goes back to the network
  -> Temporary disruption

- Inverter did not connect to the grid?
  -> Hotline (Monday to Friday 8:00 to 17:00)
- Stand by: type, serial number and exact description?
  (Error code, frequency of error)

- Replacement unit will be delivered

Confidential

Error Messages (1)

CODE	Displayed description	Possible cause	Action
E001	Input Overcurrent	Inpuy current-Sensor defective Boost MOSFET defective Wrong Stringconfiguration	Check string configuration otherwise: Inverter Swap
E002	**Input Overvoltage**	59oV Overvoltage surge protection Wrong String wiring Module/ String number zu high	Wiring verification PV configuration verification
E003	No parameters	Wrong communication between DSPs	Inverter Swap
E004	**Bulk Overvoltage**	Wrong String wiring Module/ String number zu high	Wiring /PV configuration verification
E005	Communication Error	No communikation between Micro and DSP	Inverter Swap
E006	Output Overcurrent	If error occurs randomly: Rapid change in grid voltage. -> inverter goes back on line Permanent error: Problems with the current measurement	The network parameters verification otherwise Inverter swap
E007	**IGBT Sat**	Overcurrent in the bridge: If error occurs randomly: change of the grid voltage, leakage current problem? Permanent error: HW error	Check the DC insulation. If E007 is displayed before the grid connection could the cause be a leakage current. Otherwise: exchange

Confidential

Error Messages (2)

CODE	Displayed description	Possible cause	Action
E008	**Bulk undervoltage**	Wrong PV wiring HW Problem in Booster circuit	String configuration and radiation verification Otherwise: Inverter swap
E011	Ramp Fail	Hardware Problem	Inverter swap
E012	DC-DC Error	Hardware Problem	Inverter swap
E013	**Wrong Mode**	Input configuration wrong set up: Schalter steht auf parallel: Strings sind aber nicht parallel: NEUSTART erforderlich!	MPP Mode correct set up
E014	**Overtemperature**	Internes Problem oder extrem hohe Umgebungstemperature	Mountinh verification: Otherwise exchange
E015	Bulk Capacitor Fail	Hardware Problem	Inverter swap
E016	Inverter Fail	Internal Problem in DC-AC Stage	Inverter swap
E017	Start Timeout	Probleme with DSP Software	Inverter swap
E018	**Ileak Failure**	Leakage current to high or measurement failure	Insulation of AC and DC Side check. Moisture can Increase the leakage current Otherwise: exchange
E019	Ileak Sensor fail	Leakage current measurement failure	Inverter swap

Confidential

Error Messages (3)

CODE	Displayed description	Possible cause	Action
E020	DC-DC Relais Fail	Input relay failure	Inverter swap
E021	Inverter Relais fail	Output relay failure	Inverter swap
E022	Autotest timeout	Internal failure	Inverter swap
E023	DC Injection Error	DC voltage Sensor failure	Inverter swap
E024	Unknown Error	Unknown internal failure	Inverter swap
E025	**Riso low**	PV Field insulation failure (Insulation-resistance < 1 Mohm)	Insolation resistance of Module verifcation or externe Overvoltage surge arresters check
E026	VRef Error	Internal reference out of limit	Inverter swap
E027	VGrid measure Fault	Redundant grid voltage meaurement out of limit	Grid voltage verification Otherwise: Inverter swap
E028	FGrid Measure Fault	Redundant grid frquency meaurement out of limit	Check country settings of inverter (IT for Italy, DE for Germany, etc.) , check frequency: Otherwise Inverter Swap

Confidential

Error Messages (4)

CODE	Displayed description	Possible cause	Action
E029	Zgrid Measure Failure	Redundant impedance measurement out of limit	Country set up verification Otherwise : Inverter Swap
E030	Ileak Measure Fault	Redundant Leakge current measurement out of limit	Inverter swap
E031	Wrong V Measure	Redundant internal reference voltage measurement out of limit	Inverter swap
E032	Wrong I Measure	Redundante internal reference current measurement out of limit	Inverter swap
E033	Undertemperature	Tempere measurement failure	Inverter swap
E034	Interlock fail	Internal failure	Inverter swap
E036	VOut Avg	Average grid voltage is out of limit	Grid voltage and set up verification Ansonsten: Otherwise inverter swap
E037	Isolationsproblem (nur im Amorph Mode möglich)	Pole grounding is no longer guaranteed	Pole grunding verification
E038	Mid Bulk OV	Unbalanced voltage distribution of the bulk capacitors	Inverter swap

Confidential

Warnings (1)

CODE	Displayed description	Possible cause	Action
W001	Sun low	Insufficient radiation. Number of modules / string too small. Incorect wiring	No action… waiting for Sun Configuration and wiring verification
W002	Input undervoltage	Input voltage to low As W001	No action… waiting for Sun Configuration and wiring verification
W003	Grid Fail	Grid voltage out of limit	Grid voltage, frequency, inverter settings and AC wiring verificaion
W004	Grid Overvoltage		
W005	Grid Undervoltage		
W006	Grid Overfrequency	Grid frquency out of limit	
W007	Grid Underfrequency		
W008	Z Grid out of Range	Grid impedance out of limit	Wiring and gridimpedance parametrs verification
W010	Fan Fail	Fan failure	Check if the fan is blocked because dirt, failure may cause derrating -> replace
W011	Bulk undervoltage	Input voltage to low	Configuration verification
W012	Clock Battery low	Low battery (device stays on the grid)	Battery replace
W013	Clock Failure	Problem with the time (unit remains on the grid)	Set time. If the problem shows up again -> Swap inverter

Confidential

Warnings (2)

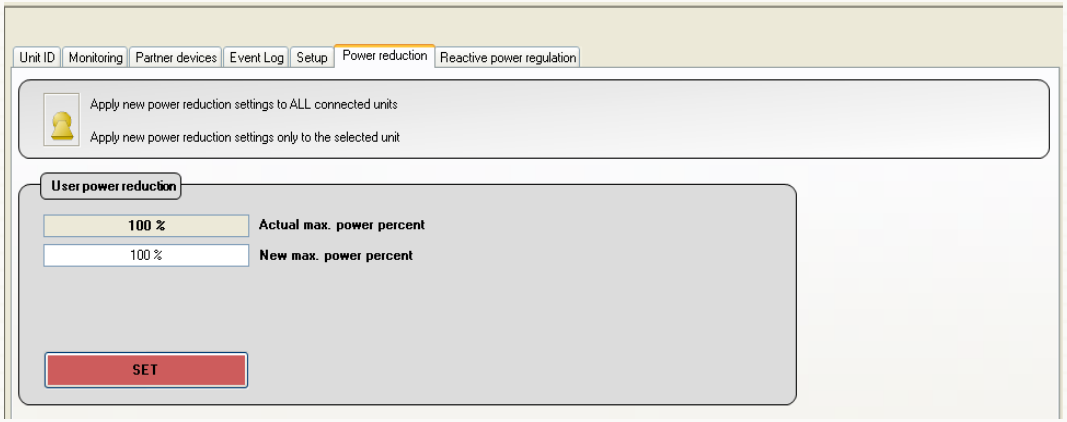
CODE	Displayed description	Possible cause	Action
W017	Jbox Fail	Fuses in connection box failed	Fusses replace
W018	SPD DC open	Overvoltage surge arrester on DC Seide interrupted	Surge arrester replace
W019	SPD AC open	Overvoltage surge arrester on AC Seide interrupted	Surge arrester replace

Note:
Not all error messages and warnings are available on all devices

Confidential

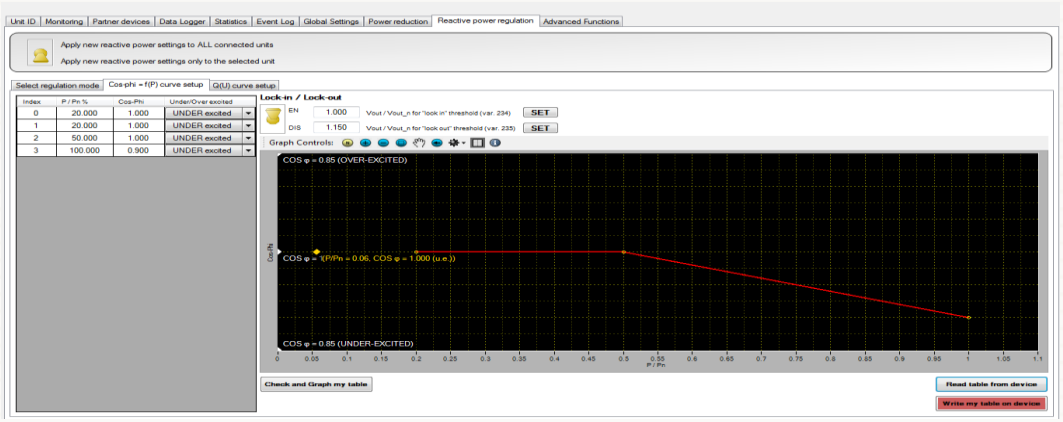
Software Aurora Manager-LITE (1)

Used with the TRIO-20.0/27.6 and UNO-2.0/2.5-I devices



Active power set up

Reactive power set up



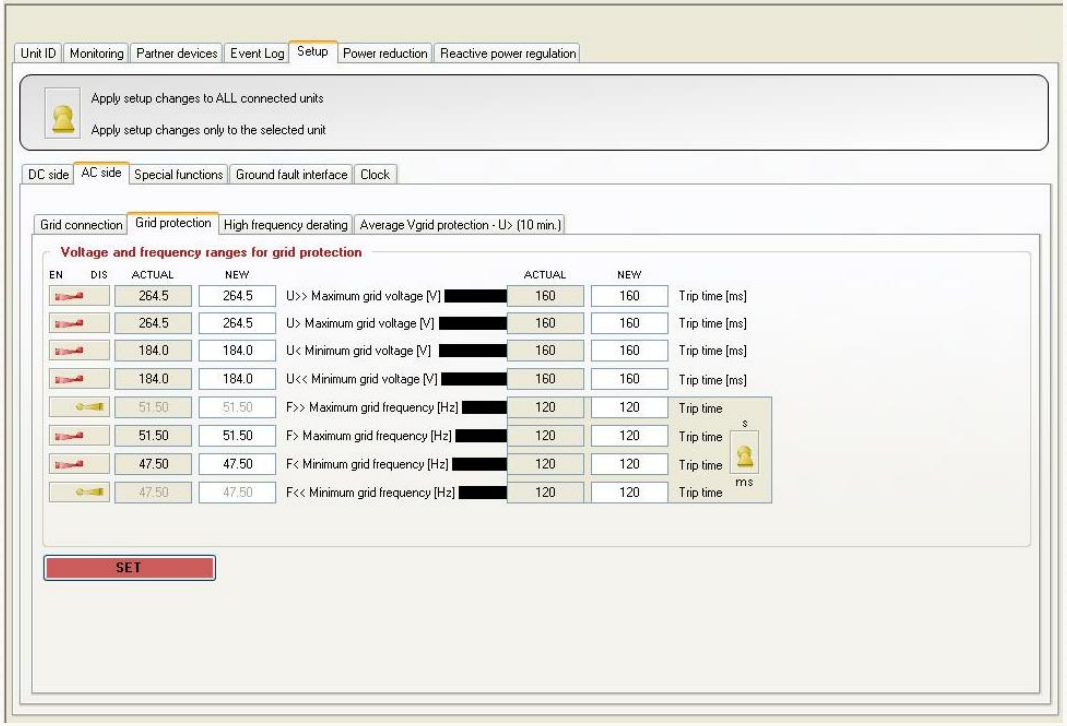
Detailed information is available in the description of the software

Confidential

power-one® A MEMBER OF THE ABB GROUP

Software Aurora Manager-LITE (2)

Software «Aurora Manager-LITE



Set up of AC Parameter

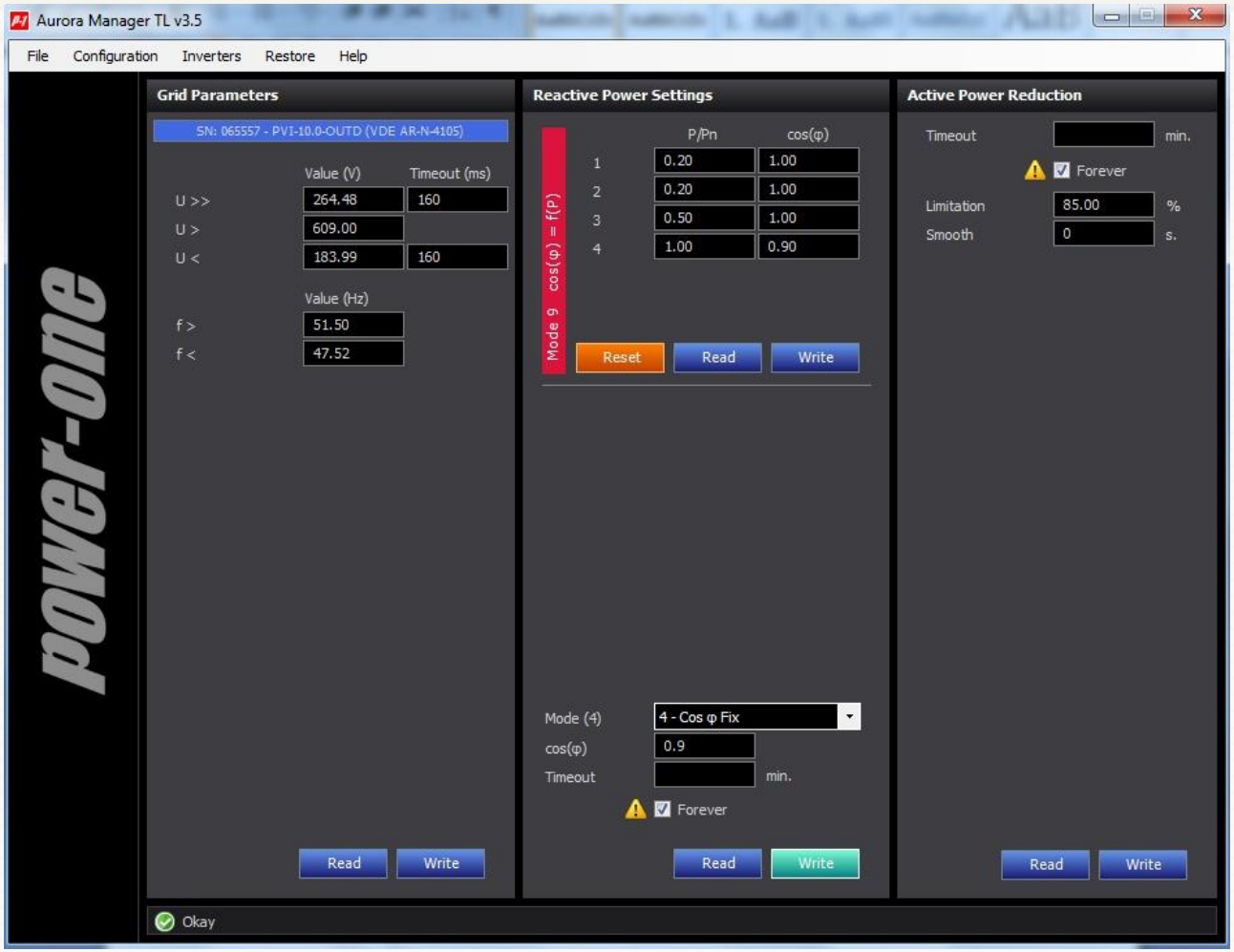
Detailed information is available in the description of the software

Confidential

power-one® A MEMBER OF THE ABB GROUP

Settings using software tools

Used with the PVI-10.0/12-5 and PVI-3.0/3.6/4.2-TL devices



Detailed information is available in the description of the software

Confidential

power-one® A MEMBER OF THE ABB GROUP

Program

Company presentation

Product overview and technical data

Topology and functions

Installation

Commisioning and operation

Communication and monitoring

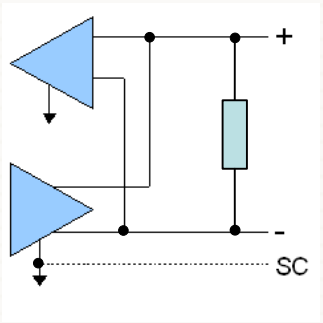
Correct sizing with Aurora Designer or Stringsizer

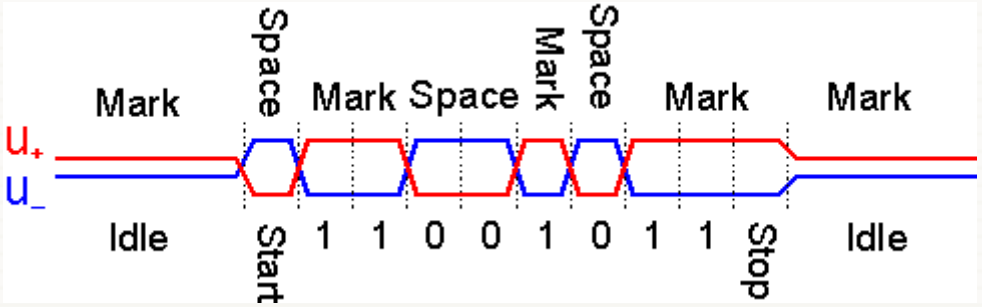
Communication: RS485

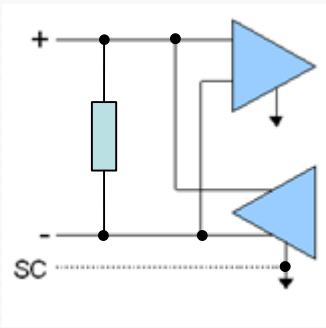
RS485 signals are floating and each signal is transmitted over a **+** line and a **-** line.

RS485 receiver compares the *voltage difference* between both lines, instead of the *absolute voltage level* on a signal line.

With **RS485** there is no any common zero as a signal reference.
Several volts difference in the ground level of the **RS485** transmitter and receiver does not cause any problems.

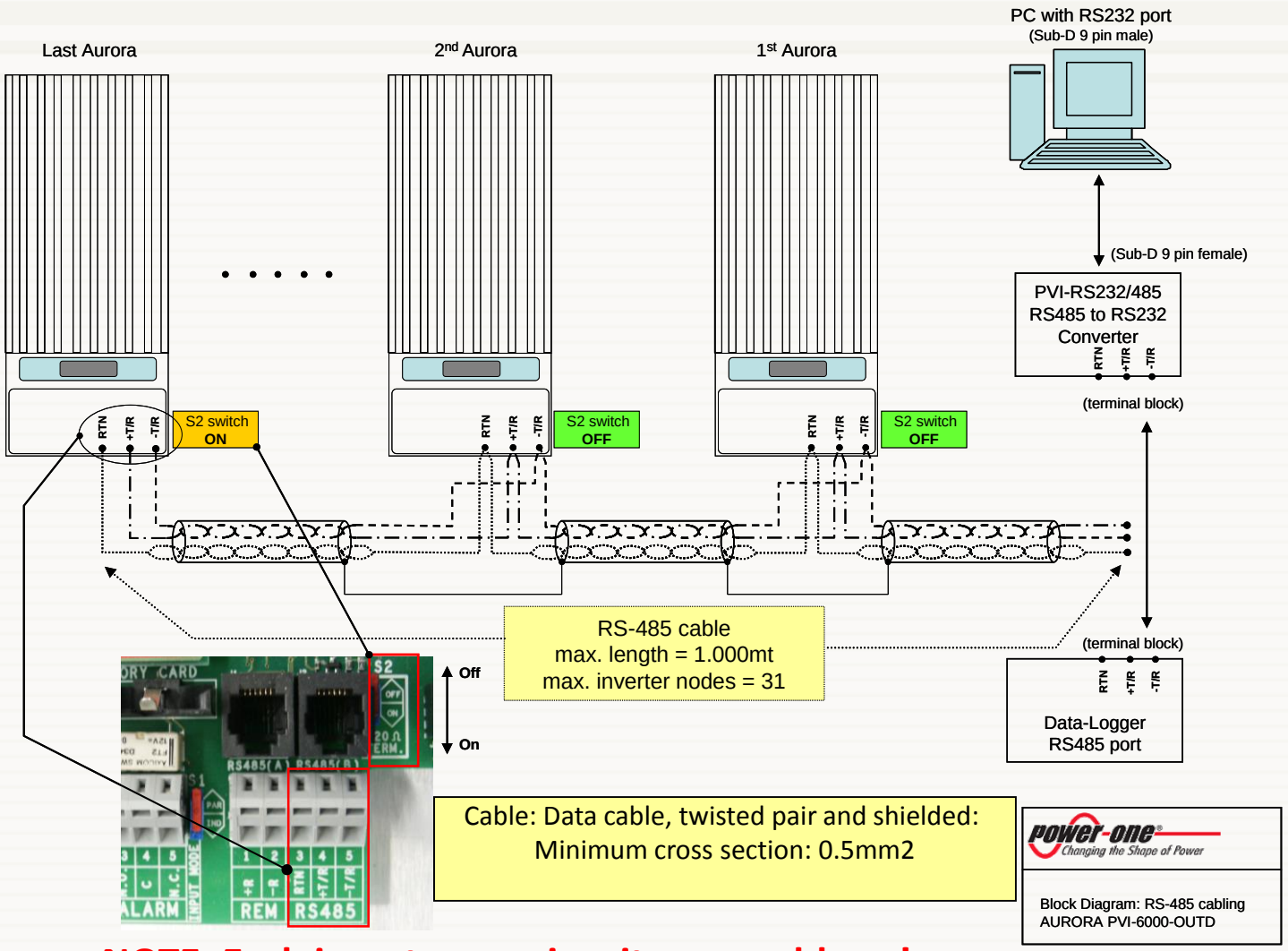






Confidential
power-one
A MEMBER OF THE ABB GROUP

Communication: wiring



NOTE: Each inverter requires its own address!

Confidential

power-one
A MEMBER OF THE ABB GROUP

Cables for RS485 applications

Example: BELDEN

Description	Part No.	UL NEC/ C(UL) CEC Type	No. of Pairs	Color Code	Standard Lengths Ft.	Standard Lengths m	Standard Unit Weight Lbs.	Standard Unit Weight kg	Nom. DCR Cond.	Nom. DCR Shield	Nominal OD Inch	Nominal OD mm	Nom. Imp. (Ω)	Nom. Vel. of Prop.	Nom. Capacitance • pF/Ft.	Nom. Capacitance • pF/m	Nom. Capacitance •• pF/Ft.	Nom. Capacitance •• pF/m
24 AWG Stranded (7x32) TC Conductors • Overall Beldfoil® (100% Coverage) + TC Braid Shield (90% Coverage) • 24 AWG Stranded TC Drain Wire																		
Polyethylene Insulation • Chrome PVC Jacket																		
UL AWM Style 2919 (30V 80°C) DMX 512	9841	NEC: CM CEC: CM	1	See Chart 5 (Tech Info Section)	100	30.5	4.3	2.0	24.0Ω/M' 78.7Ω/km	3.4Ω/M' 11.0Ω/km	.232	5.89	120	66%	12.8	42.0	23.0	75.5
					500	152.4	20.0	9.1										
					1000	304.8	40.0	18.2										
													For Plenum versions of 9841, see 82841 or 89841.					
	9842	NEC: CM CEC: CM	2	See Chart 5 (Tech Info Section)	100	30.5	5.8	2.6	24.0Ω/M' 78.7Ω/km	2.2Ω/M' 7.2Ω/km	.340	8.64	120	66%	12.8	42.0	23.0	75.5
					500	152.4	29.5	13.4										
					1000	304.8	57.0	25.9										
													For Plenum versions of 9842, see 82842.					
	9843	NEC: CM CEC: CM	3	See Chart 5 (Tech Info Section)	100	30.5	7.1	3.2	24.0Ω/M' 78.7Ω/km	2.3Ω/M' 7.7Ω/km	.360	9.14	120	66%	12.8	42.0	23.0	75.5
					500	152.4	34.5	15.7										
					1000	304.8	67.0	30.5										
	9844	NEC: CM CEC: CM	4	See Chart 5 (Tech Info Section)	500	152.4	43.0	19.5	24.0Ω/M' 78.7Ω/km	2.1Ω/M' 6.9Ω/km	.390	9.91	120	66%	12.8	42.0	23.0	75.5
					1000	304.8	83.0	37.7										
Plenum • Foam FEP Insulation • Natural Flamarrest® Jacket																		
300V RMS	82841	NEC: CMP CEC: CMP FT6	1	See Chart 5 (Tech Info Section)	500	152.4	13.0	6.0	24.0Ω/M' 78.7w/km	3.1Ω/M' 10.2Ω/km	.204	5.18	120	76%	12	39.4	22	72.2
					1000	304.8	26.0	11.8										
300V RMS	82842	NEC: CMP CEC: CMP FT6	2	See Chart 5 (Tech Info Section)	500	152.4	19.0	8.6	24.0Ω/M' 78.7Ω/km	2.4Ω/M' 7.9Ω/km	.273	6.93	120	76%	12	39.4	22	72.2
					1000	304.8	42.0	19.1										
Plenum • Foam FEP Insulation • Red FEP Jacket																		
300V RMS	89841	NEC: CMP CEC: CMP FT6	1	See Chart 5 (Tech Info Section)	500	152.4	13.5	6.1	24.0Ω/M' 78.7Ω/km	3.1Ω/M' 10.2Ω/km	.202	5.13	120	76%	12	39.4	22	72.2
					1000	304.8	27.0	12.3										
300V RMS	89842 new	NEC: CMP CEC: CMP FT6	2	See Chart 5 (Tech Info Section)	500	152.4	25.5	11.6	24.0Ω/M' 78.7Ω/km	3.1Ω/M' 10.2Ω/km	.305	7.75	120	76%	12	39.4	22	72.2
					1000	304.8	49.0	22.2										

DCR = DC Resistance • TC = Tinned Copper

*Capacitance between conductors.

**Capacitance between one conductor and other conductors connected to shield.

Confidential

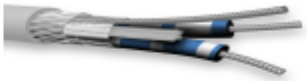
power-one® A MEMBER OF THE ABB GROUP

Cables for RS485 applications

Example: CEAM

CAVI PER APPARECCHIATURE ELETTRONICHE - EIA RS485
ELECTRONIC EQUIPMENTS CABLES - EIA RS485

POSA FISSA - *FIXED INSTALLATION*

ARTICOLO *ITEM*	CPR 6003 (Y09841) 1×2×24/7AWG (0,22mm²)	Y09842 2×2×24/7AWG (0,22mm²)
codice *Part Number*	0502014	0925162
2002/95/EC RoHS compliant		
APPLICAZIONE *APPLICATION*	collegamento in RS485 di dispositivi elettronici *electronic devices connection with RS485 interface*	collegamento in RS485 di dispositivi elettronici *electronic devices connection with RS485 interface*
COSTRUZIONE *CONSTRUCTION*		
conduttori - *conductors*	CuSn - 7×0,20mm ∅ (24/7AWG)	CuSn - 7×0,20mm ∅ (24/7AWG)
isolamento - *insulation*	PE	PE
colorazione e formazione coppia *colour code and pair assembly*	bianco/blu + blu/bianco / *white/blue + blue/white*	(1) bianco/blu + blu/bianco / *white/blue + blue/white* (2) bianco/arancio + arancio/bianco / *white/orange + orange/white*
schermatura *shield*	nastro AL/PET + cond. continuità CuSn 24/7AWG + treccia in CuSn (k ≥ 90%) *AL/PET tape + CuSn drain wire 24/7AWG + CuSn braid (k ≥ 90%)*	nastro AL/PET + cond. continuità CuSn 24/7AWG + treccia in CuSn (k ≥ 90%) *AL/PET tape + CuSn drain wire 24/7AWG + CuSn braid (k ≥ 90%)*
guaina esterna *outer jacket*	FR PVC ∅ 6,7 mm colore grigio RAL7001 - *grey RAL7001 colour*	FR PVC ∅ 8,6 mm colore grigio RAL7001 - *grey RAL7001 colour*
peso indicativo - *approx. weight*	63 kg/km	98 kg/km
PROPRIETA' ELETTRICHE E TRASMISSIVE *ELECTRICAL AND TRANSMITTING PROPERTIES* [@ 20°C]		
resistenza *resistance*	85 Ω/km (conduttore interno / *inner conductor*) 11 Ω/km (schermatura / *shield*)	85 Ω/km (conduttore interno / *inner conductor*) 7,6 Ω/km (schermatura / *shield*)
capacità C/C (C/S) *capacitance C/C (C/S)*	45 (76) pF/m	45 (79) pF/m
velocità di propagazione *propagation velocity*	67 %	67 %
impedenza *impedance*	120 Ω	120 Ω
attenuazione *attenuation*	1,0 dB/100m @ 100 kHz 1,6 dB/100m @ 500 kHz 2,2 dB/100m @ 1 MHz	1,0 dB/100m @ 100 kHz 1,6 dB/100m @ 500 kHz 2,2 dB/100m @ 1 MHz
resistenza d'isolamento, min *min insulation resistance*	2,0 GΩ×km	2,0 GΩ×km
max tensione operativa *max operating voltage*	30 V	30 V

Confidential
power-one® A MEMBER OF THE ABB GROUP

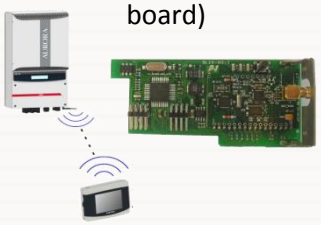
Monitoring - Power-One offer

Local monitoring

Remote monitoring

PVI-USB-RS485_232
(USB / RS-485&RS-232 converter)

PVI-RADIOMODULE
(wireless communication board)



PVI-CDD
(data logger for AURORA MICRO)

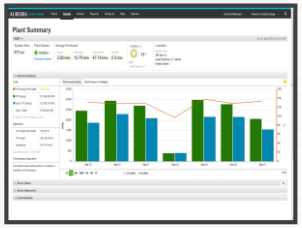
PVI-AEC-EVO
(*EVO* data logger)

VSN-MGR-RES-P1
(AURORA LOGGER data logger)

AURORA COMMUNICATOR
(Local monitoring sw platform)

PVI-DESKTOP
(Remote display)

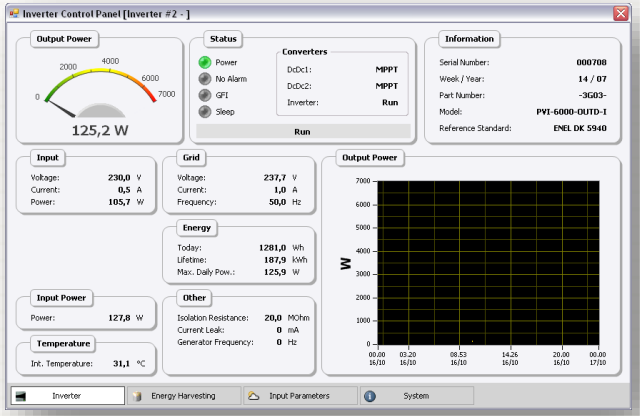
AURORA VISION
(Advanced web portal)

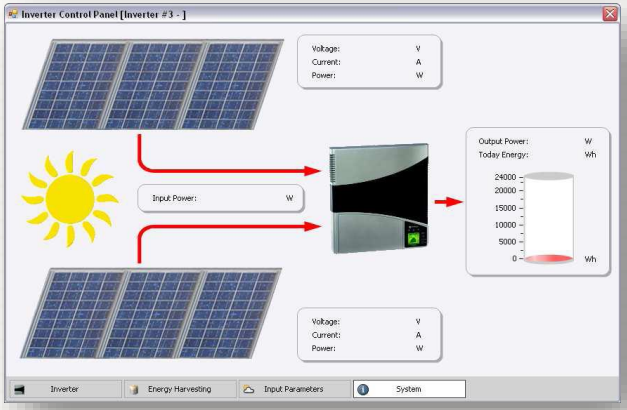


AURORA EASYVIEW
(Residential web portal)

AURORA Communicator - local monitoring

Communications-Software



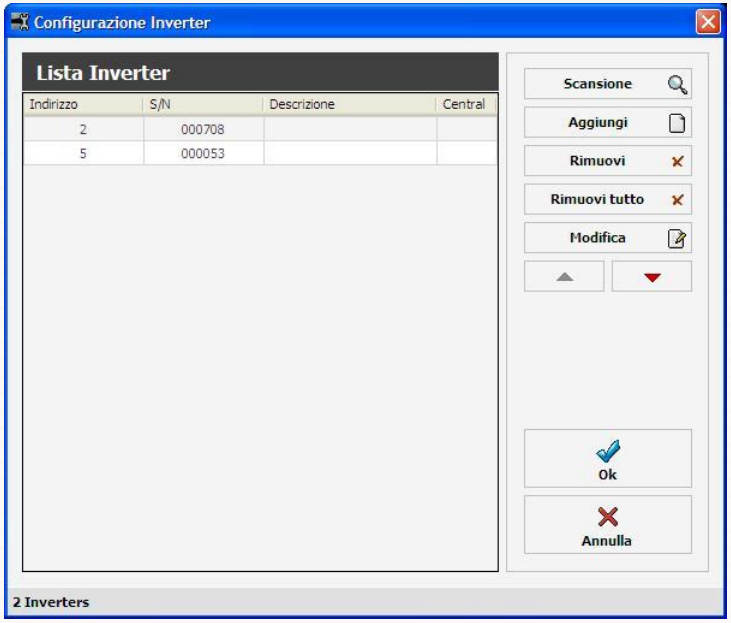


Confidential

power-one® A MEMBER OF THE ABB GROUP

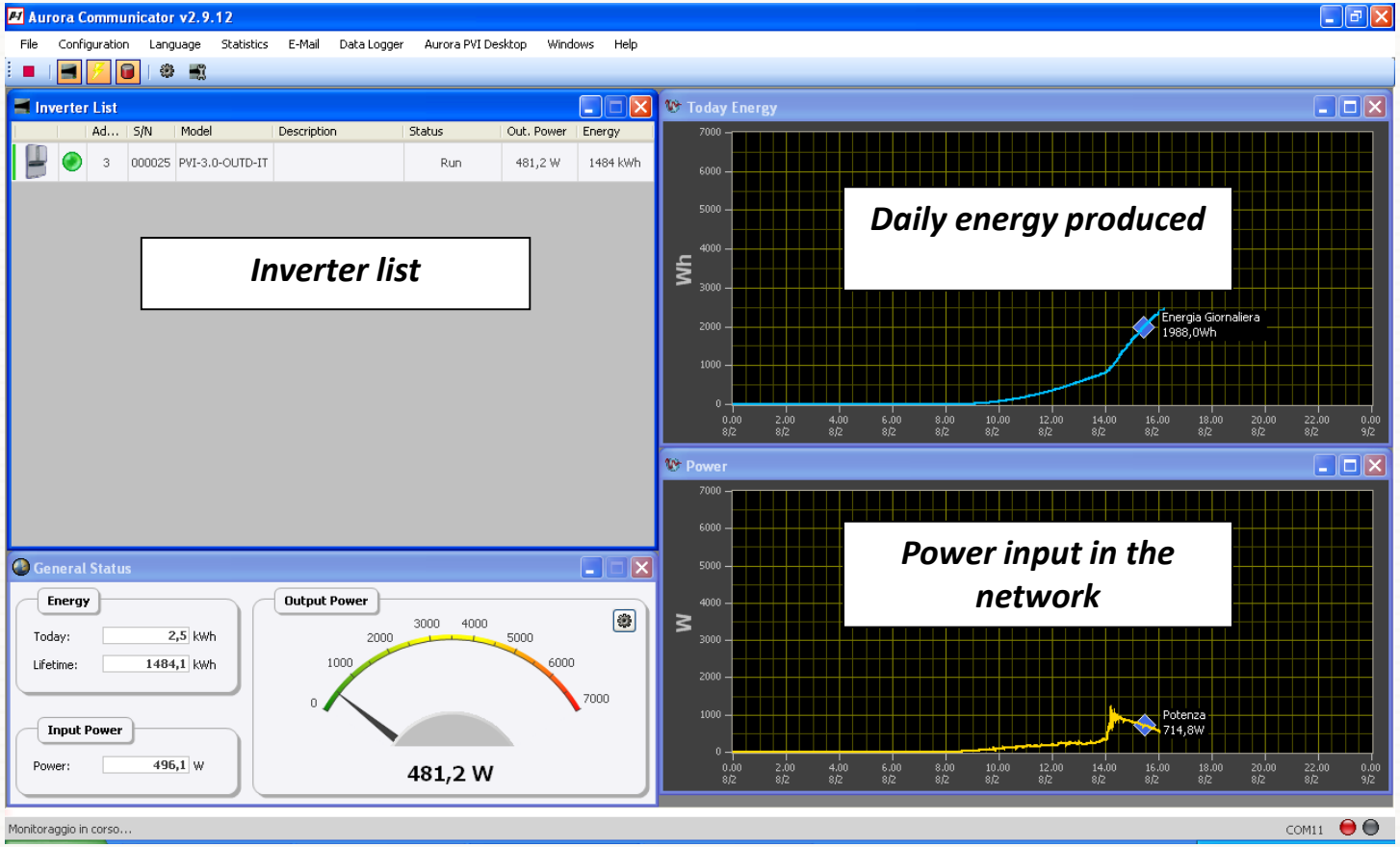
The Aurora Communicator Software

Scanning of the RS485 bus



It allows for the identification of all the inverters present on the RS485 bus and the creation of the Inverter List, which will be acquired during monitoring.

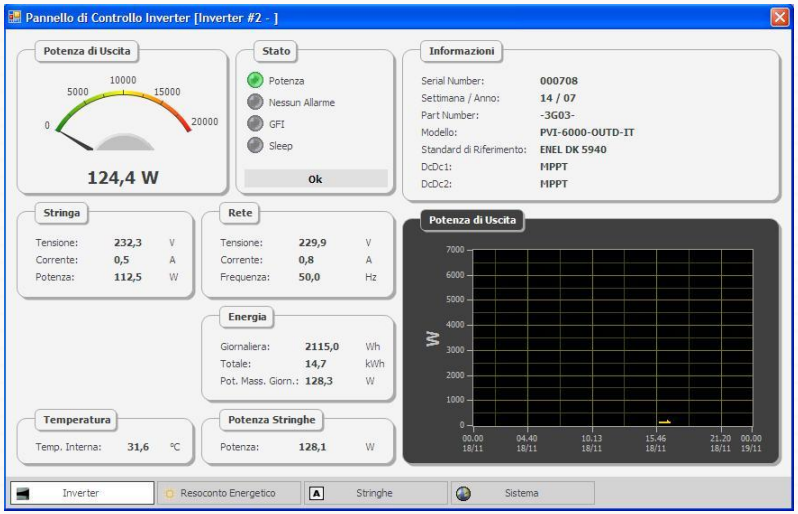
The Aurora Communicator Software



The Aurora Communicator Software

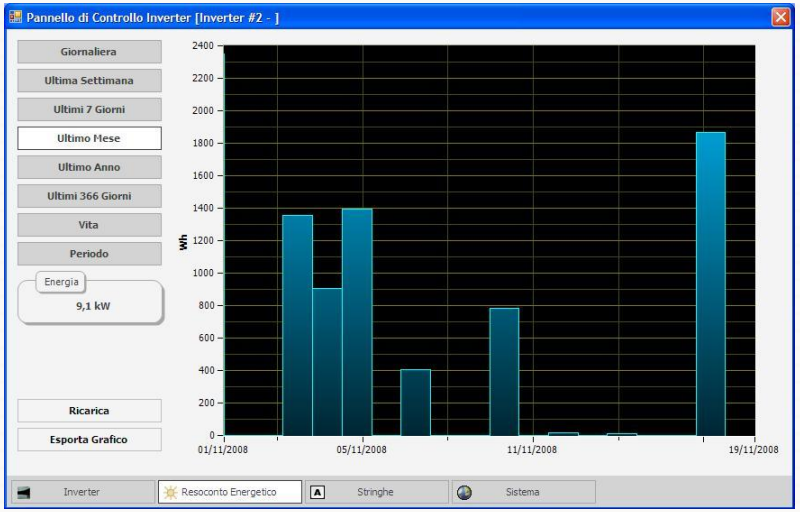
Inverter control panel

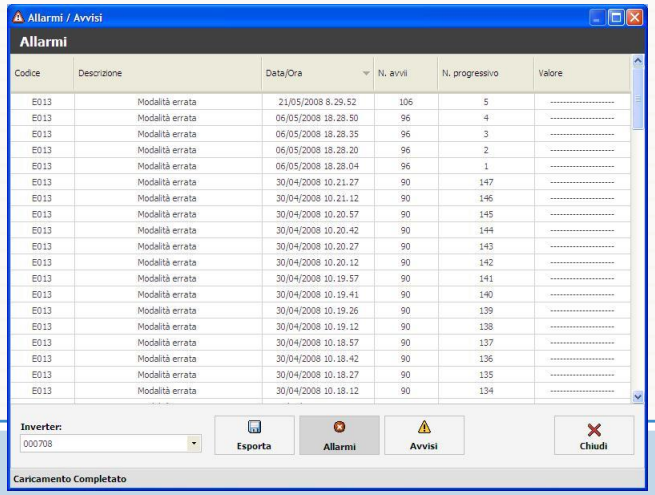
Detailed status and parameters for the single inverter



Inverter control panel
Energy summary

Download of daily energy production (365 values) with the possibility of exporting in csv format for further analysis



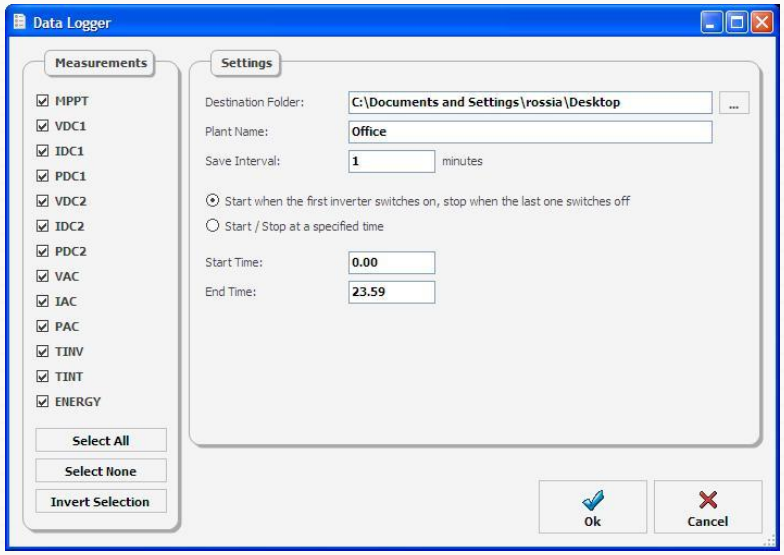


Statistics menu

Download of the inverter fault log (diagnostics) with the possibility of exporting as a text file

The Aurora Communicator Software

Data Logger Functionality



It allows for the creation of text files with detailed information acquired from the inverters with a selectable sample period and selectable parameters list.

Complete freedom to analyze the detailed data of each inverter!

```
[info]
System name: Office
Date: 08/10/2008

[measurements]
Time;Address;Model;MPPT;VDC1;IDC1;PDC1;VDC2;IDC2;PDC2;VAC;IAC;PAC;TINV;
TINT;ENERGY;
;;;;VDC;ADC;W;VDC;ADC;W;V;A;W;°C;°C;Wh;

[start]
11.37;2;PVI-6000-OUTD-
IT;S;234,2;0,3;109,7;233,4;0,2;36,8;0,0;0,5;122,8;31,2;30,3;0,0;
11.37;3;PVI-3600-OUTD-IT;D;0,0;0,0;0,0;0,0;0,0;0,0;0,0;0,0;0,0;0,0;0,0;0,0;0,0;0,0;0,0;0,0;0,0;0,0;
11.37;4;PVI-3600-IT;D;0,0;0,0;0,0;0,0;0,0;0,0;0,0;0,0;0,0;0,0;0,0;0,0;0,0;0,0;0,0;0,0;0,0;0,0;
11.38;2;PVI-6000-OUTD-
IT;S;233,2;0,3;110,2;232,4;0,2;37,3;229,7;0,5;125,9;31,2;30,3;508,0;
11.38;3;PVI-3600-OUTD-
IT;D;227,8;0,6;134,9;38,1;0,0;0,4;229,2;0,4;124,1;33,6;32,7;502,0;
11.38;4;PVI-3600-
IT;D;232,3;0,4;82,2;61,6;0,0;0,0;229,7;0,5;124,1;40,5;37,9;509,0;
11.39;2;PVI-6000-OUTD-
IT;S;233,3;0,3;110,6;232,5;0,2;36,9;229,9;0,5;122,0;31,3;30,3;510,0;
11.39;3;PVI-3600-OUTD-
IT;D;228,9;0,6;135,0;38,1;0,0;0,4;231,2;0,4;123,3;33,6;32,8;504,0;
11.39;4;PVI-3600-
IT;D;232,2;0,4;84,9;61,6;0,0;0,0;231,5;0,5;125,1;40,5;38,0;511,0;
11.40;2;PVI-6000-OUTD-
IT;S;233,7;0,3;109,6;232,9;0,2;36,8;230,8;0,5;126,7;31,3;30,3;512,0;
```

String / Central Inverter Monitoring – Aurora Logger

Program

Company presentation

Product overview and technical data

Topology and functions

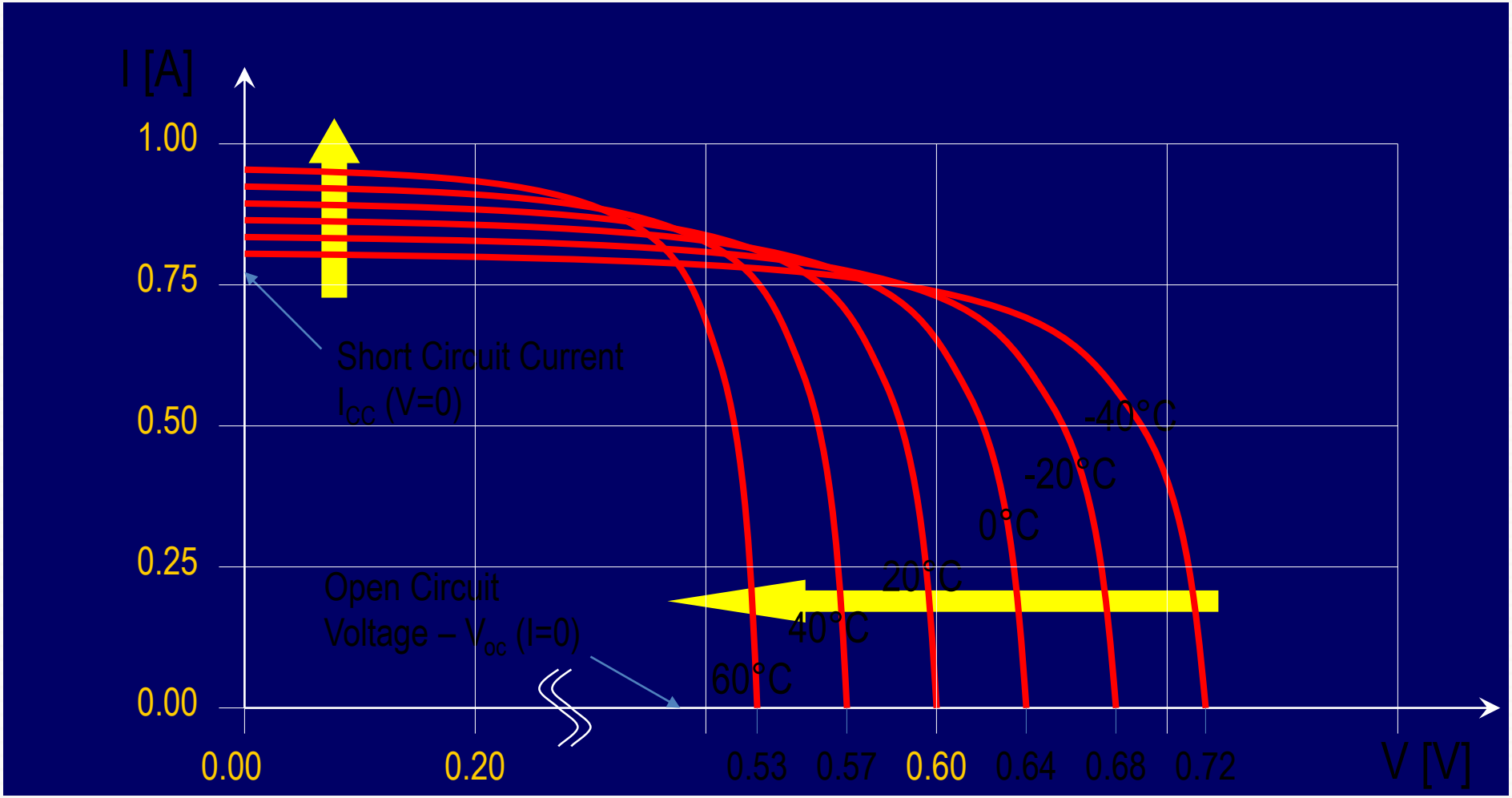
Installation

Commisioning and operation

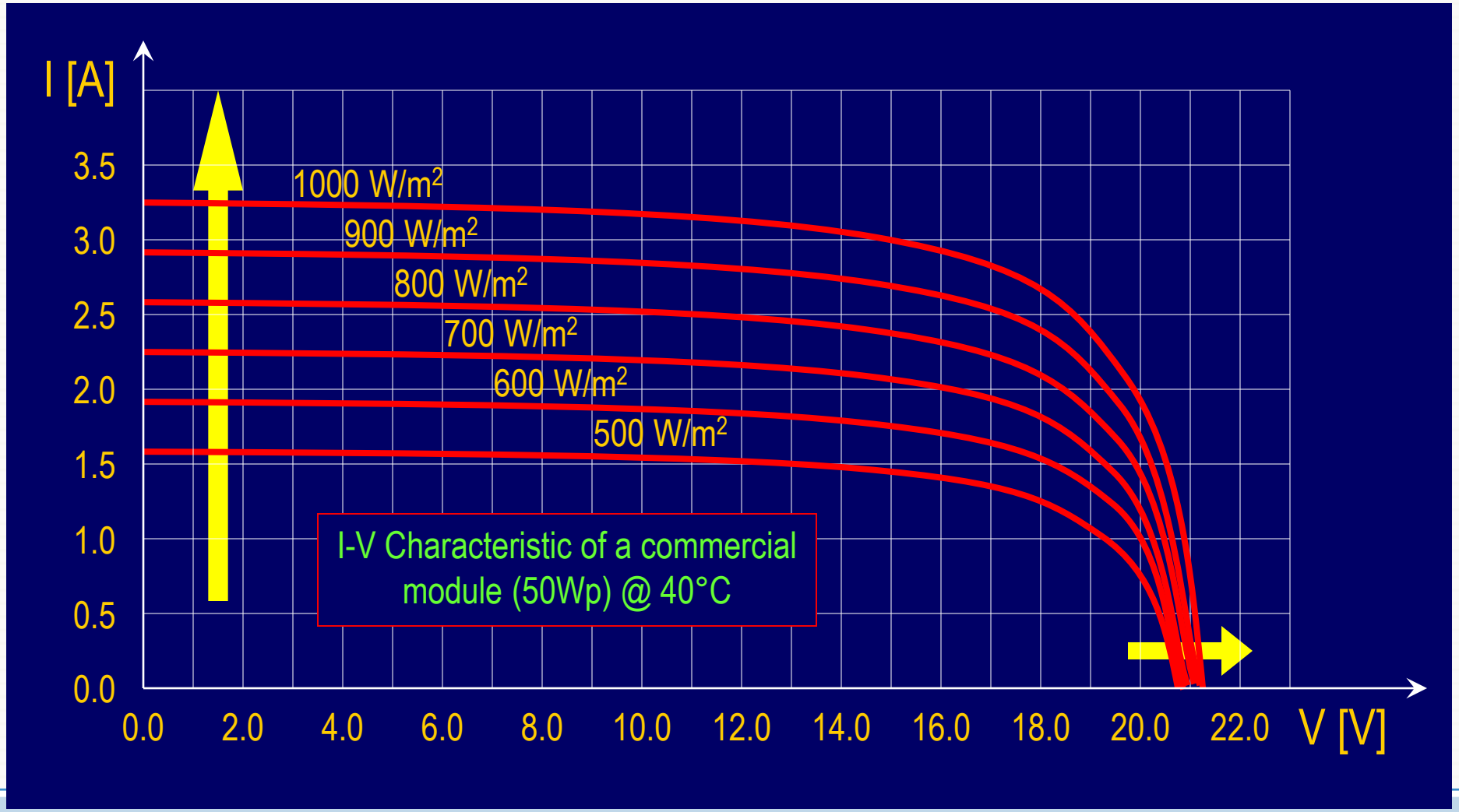
Communication and monitoring

Correct sizing with Aurora Designer or Stringsizer

Characteristic I-V of cell as a function of temperature

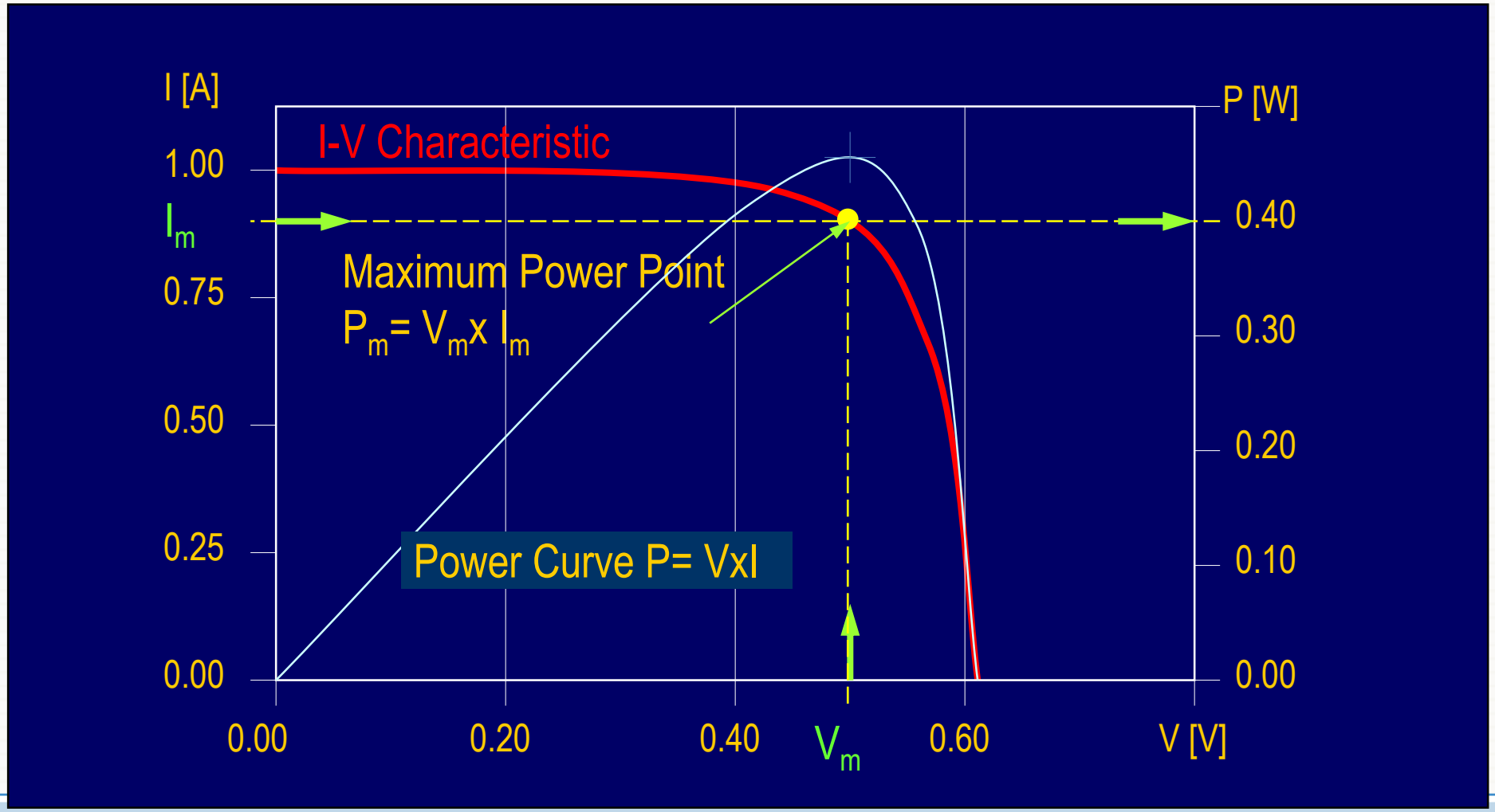


Characteristic I-V of cell as a function of Solar irradiance



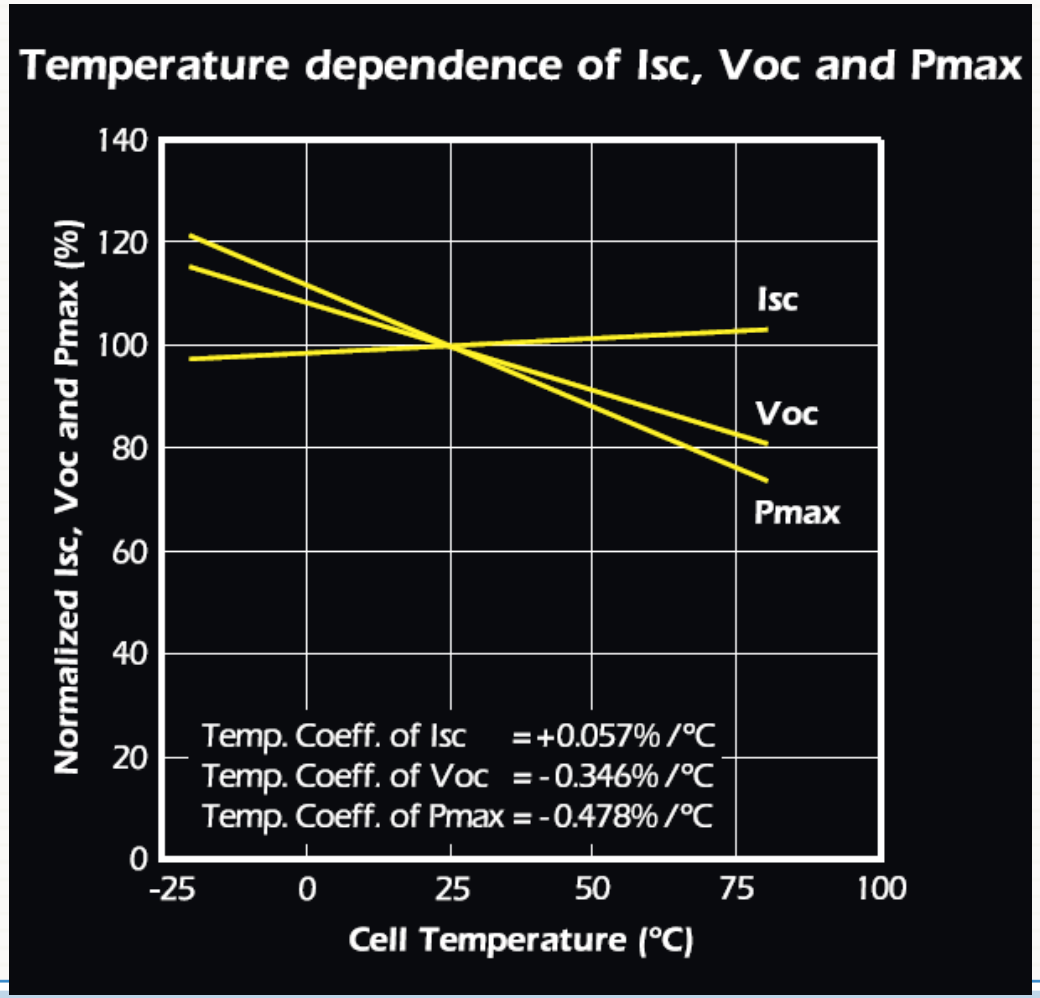
Electrical characteristics of photovoltaic modules

Characteristic I-V of cell



Electrical characteristics of photovoltaic modules

Electrical characteristics DEPEND ON TEMPERATURE!!



Typical values – silicon cells

$\alpha\ Isc_{typ} \approx + 0.04$ %/°C

(+0.03% ÷ +0.09 %/°C)

$\beta\ Voc_{typ} \approx - 0.37$ %/°C

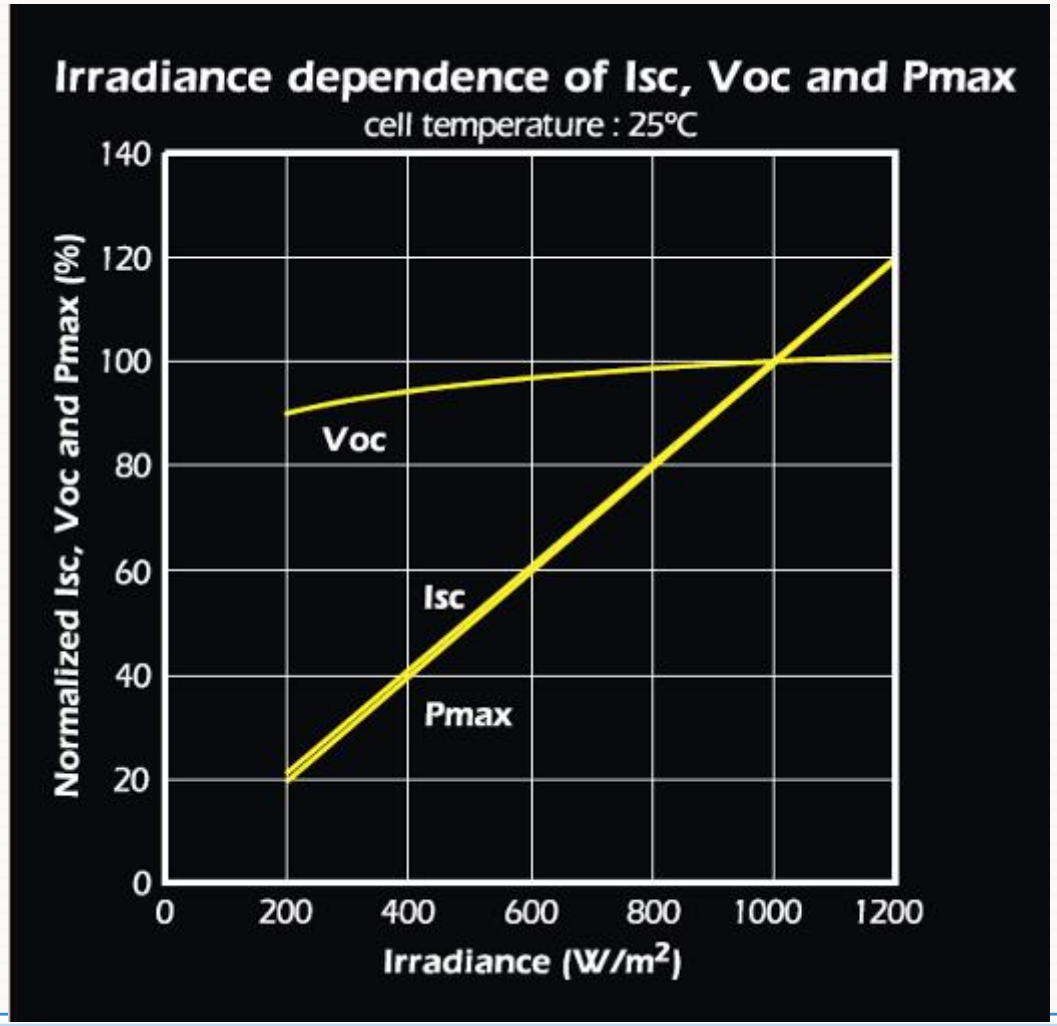
(-0.25% ÷ -0.40 %/°C)

$\gamma\ Pmp_{typ} \approx - 0.45$ %/°C

(-0.3% ÷ -0.55 %/°C)

Electrical characteristics of photovoltaic modules

Electrical characteristics as a function of irradiance



Observations:

At constant cell temperature the delivered power Pdc and current Imp are linearly related to the irradiance.

The open circuit voltage Voc drops considerably ONLY for the radiation values lower than 200W/m^2

Significant parameters and their influence on dimensioning the system

ELECTRICAL CHARACTERISTICS	
Maximum Power (Pmax)*	176 W
Tolerance of Pmax	+10%/-5%
Type of Cell	Polycrystalline silicon
Cell Configuration	48 in series
Open Circuit Voltage (Voc)	29.28 V
Maximum Power Voltage (Vpm)	23.42 V
Short Circuit Current (Isc)	8.22 A
Maximum Power Current (Ipm)	7.52 A
Module Efficiency (%)	13.3%
Maximum System (DC) Voltage	600 V
Series Fuse Rating	15 A
NOCT	47.5°C
Temperature Coefficient (Pmax)	-0.485%/°C
Temperature Coefficient (Voc)	-0.36%/°C
Temperature Coefficient (Isc)	0.053%/°C

*Measured at (STC) Standard Test Conditions: 25°C, 1 kW/m² insolation, AM 1.5

- Inverter size: 0.8 ÷ 1.3 Pdc_STC
- Type of cell (TL, insulated)
- Vdc_max @ Tmin (length of strings)
- Vmp_typ/Vmp_min (optimization of output)
- Imp_max (number of strings in parallel)
- Protection of strings in parallel
- Voltage limits on inverter operation

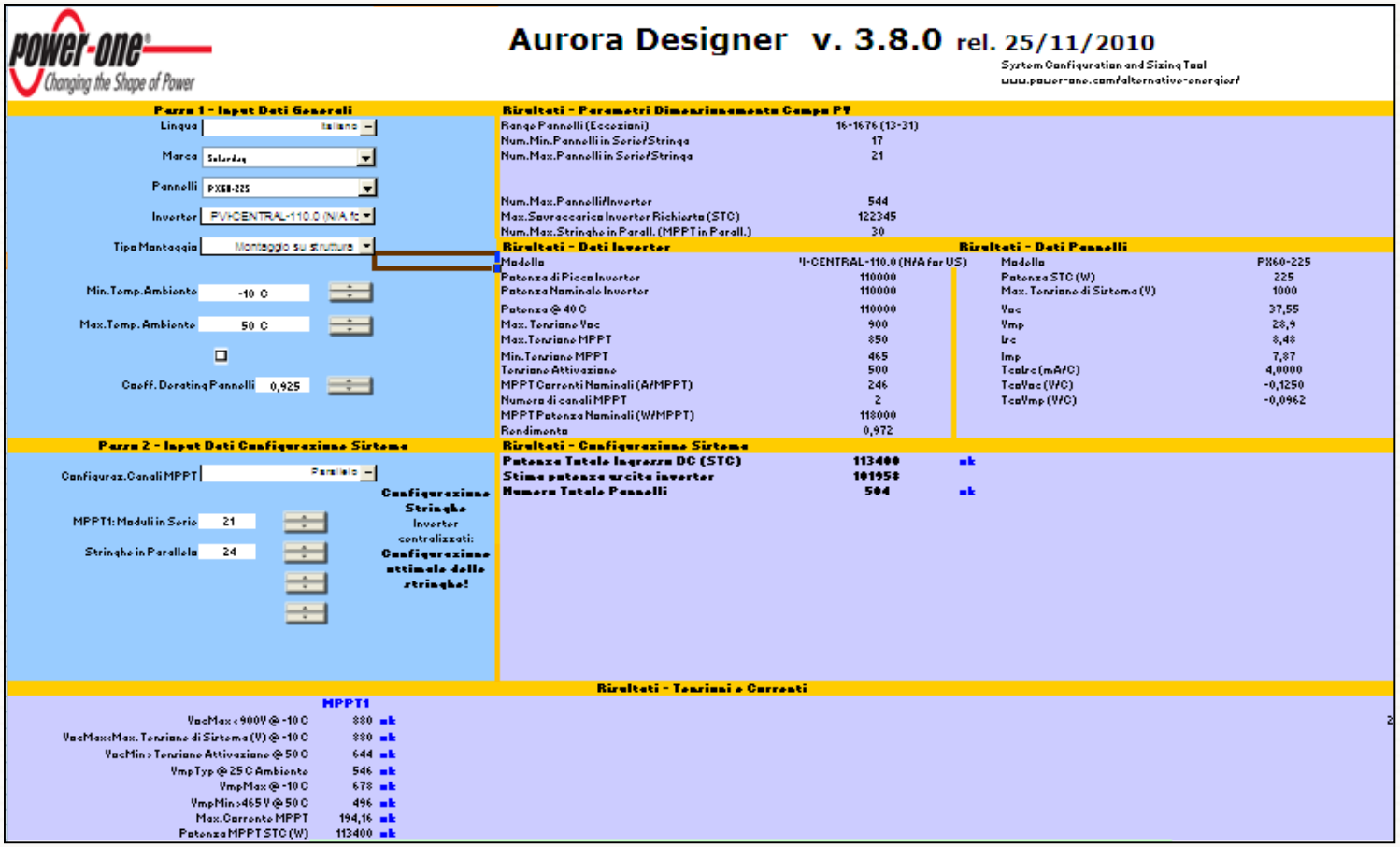
NOCT = Normal Operating Cell Temperature

Temperature reached by itself when the module is exposed to radiation of800 W/m2 and air motion flowing at1 m/s at an ambient temperature of25 °C. Lower NOCT are generally synonymous with better output in "real" operating conditions.

Dimensioning systems with Power-One inverters

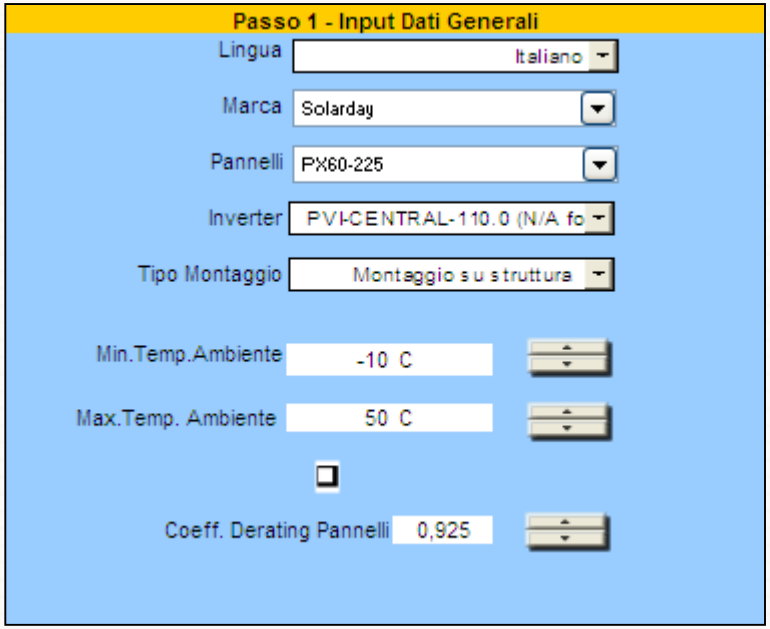
Aurora Designer

Excel spreadsheets that allow to verify the correctness of the configuration of the photovoltaic generator which is to be coupled with the inverter.



Dimensioning systems with Power-One inverters

Step-by-step procedure for configuration of the photovoltaic generator with Aurora Designer



Step 1 – General Data entry

- *Selection of language*
- *Selection of PV panels brand and model (one model only)*
- *Selection of inverter models*
- *Selection of mounting type*
- *Setting up minimum ambient temperature (also used as minimum cell temperature to calculate string voltages)*
- *Setting up maximum ambient temperature (maximum cell temperature at which the string voltages are assessed; it is assessed taking into consideration the type of mounting selected)*
- *Setting up the panel Derating Coefficient: what does the panel Derating Coefficient take into account?*

Maximum cell temperature: related to assembly type -max ambient temperature

Max cell temperature= max ambient temperature+ ΔT

Solar tracker: ΔT=25°C
Mounted on structure: ΔT=30°C
Roof mounted: ΔT=35°C

Panel derating coefficient(PDC)

Estimate of losses in DC section of system :

$$PDC = Pdc,inv / Ppv,nom$$

- Resistive losses in cables/fuses/disconnectors
- Power losses due to mismatching in the photovoltaic generator
- Losses connected to dirt/dust on the photovoltaic generator
- Decay of the panel performance
- Derating of the power available from the photovoltaic generator due to non-optimal conditions of installation

Dimensioning systems with Power-One inverters

Step-by-step configuration procedure for photovoltaic generator with Aurora Designer

Risultati - Dati Inverter	
Modello	PVI-12.5-OUTD (N/A for US)
Potenza di Picco Inverter	13800
Potenza Nominale Inverter	12500
Potenza @ 40 C	12500
Max. Tensione Voc	850
Max.Tensione MPPT	750
Min.Tensione MPPT	200
Tensione Attivazione	360
MPPT Correnti Nominali (A/MPPT)	18
Numero di canali MPPT	2
MPPT Potenza Nominali (W/MPPT)	8000
Rendimento	0,973

Step 1.1 – Inverter characteristics

In the section Inverter data are summarized the inverter characteristic parameters used for verifying the configuration.

Basic parameters:

- *Max voltage Voc: maximum input voltage for proper operation (Input OV alarm generation threshold)*
- *Activation voltage(rated)*
- *MPPT rated current*

Risultati - Dati Pannelli	
Modello	TSM-230PC05
Potenza STC (W)	230
Max. Tensione di Sistema (V)	1000
Voc	37
Vmp	29,8
Isc	8,26
Imp	7,72
TcoIsc (mA/C)	4,1300
TcoVoc (V/C)	-0,1295
TcoVmp (V/C)	-0,1043

Step 1.2 – Panel Characteristics

The Panel data section summarises the panel characteristic parameters used for the configuration.

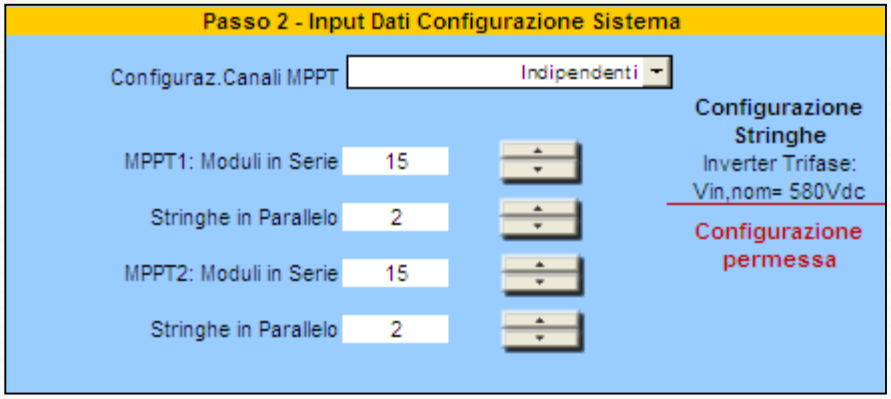
NOTE: it is recommended to verify that the electrical parameters of the selected module are aligned with the electrical parameters in the data sheet of your module.

What to do if the panel is not on the list?

- Enter the module in the database using the “Add Module” sheet
- Send an e-mail to service@power-one.com with the panel datasheet in attachment: this way the new panel will be entered into the database and the configurator thus updated will be sent back and added on our website.

Dimensioning systems with Power-One inverters

Step-by-step procedure for configuration of the photovoltaic generator with Aurora Designer



Step 2 – Data input system configuration

- *To dimension the PVI-55.0/67.0 and PVI-110.0/134.0 inverters you can directly choose the inverter models from the list of available inverters:*
  - *configuration of independent MPPT channels → Multi-Master*
  - *configuration of parallel MPPT channels → Master/Slave*
- *The dimensioning of the centralized inverters with power greater than 110/134 kW must take into consideration the modularity of the inverter, and therefore you the PVI-55.0/67.0 inverter must be selected (configuration of the single module)*
  - *If Multi-Master configuration is selected, the configuration can be freely repeated or varied*
  - *If Master/Slave configuration is selected, each module must maintain the same number of panels/string .*
  - *If Multi-Master/Slave configuration is selected, each pair of modules can be dimensioned by choosing the PVI-110.0/134.0 models with MPPT in parallel (Master/Slave) and dimensioning the generator of each framework.*

Step 3 – Evaluation of the configuration results

The configurator immediately returns a response on the feasibility/non-feasibility/optimization of the configuration!

Non-allowed configuration : one or more voltage/current exceed the inverter operation limits
Allowed cofiguration : all the voltages/currents fall within the inverter operation limits
Optimised configuration: the Vmp,typ@ Tamb=25°C voltage is around the inverter rated input voltage value.

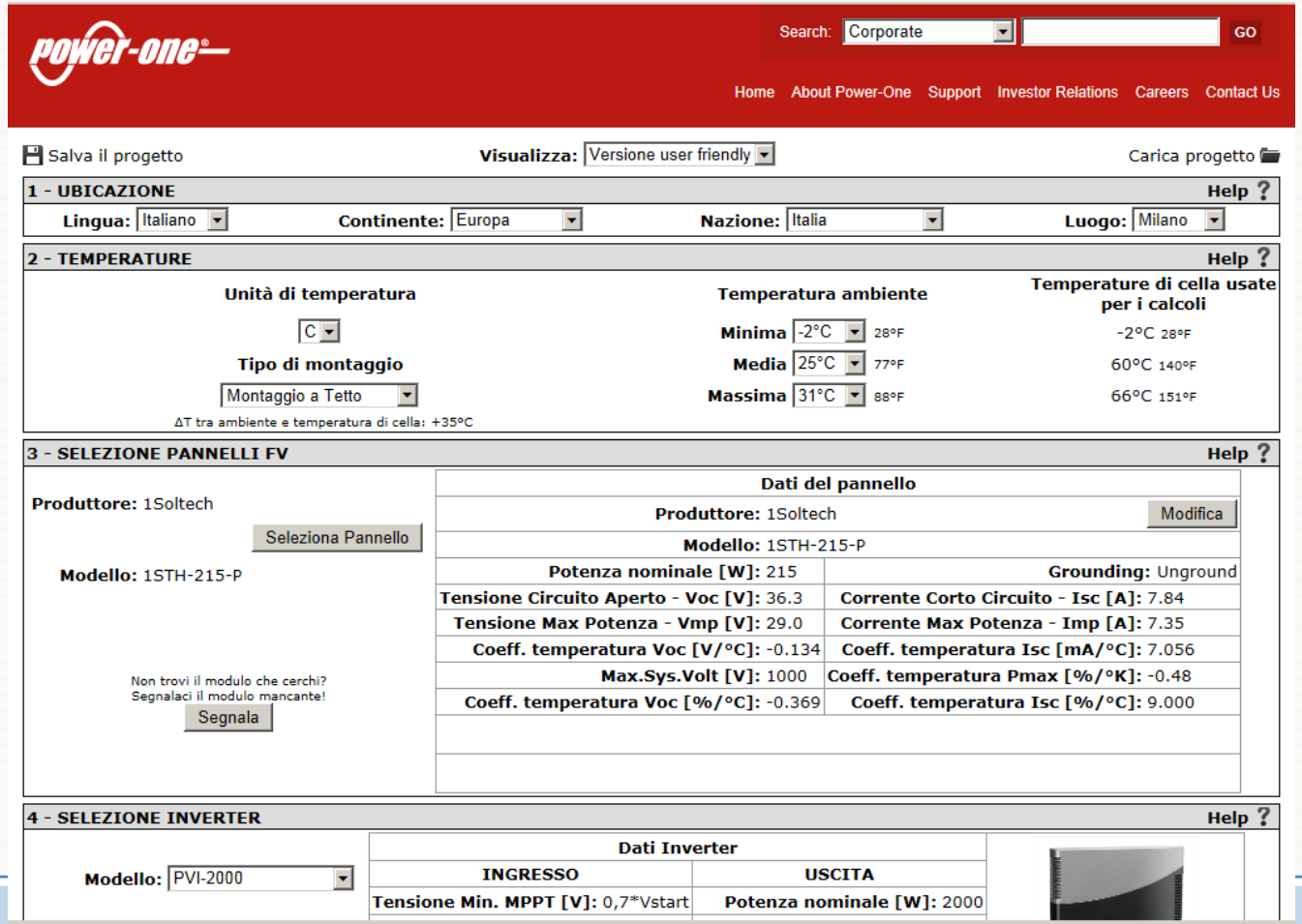
ATTENTION!

The rated installed power
DOES NOT GENERATE ALARM CONDITIONS,
but only the indication of a possible limitation of inverter power!
Though the inverter can work in limited power mode, it is not convenient because it reduces the amount of power produced by the system!

Web String Sizing Tool

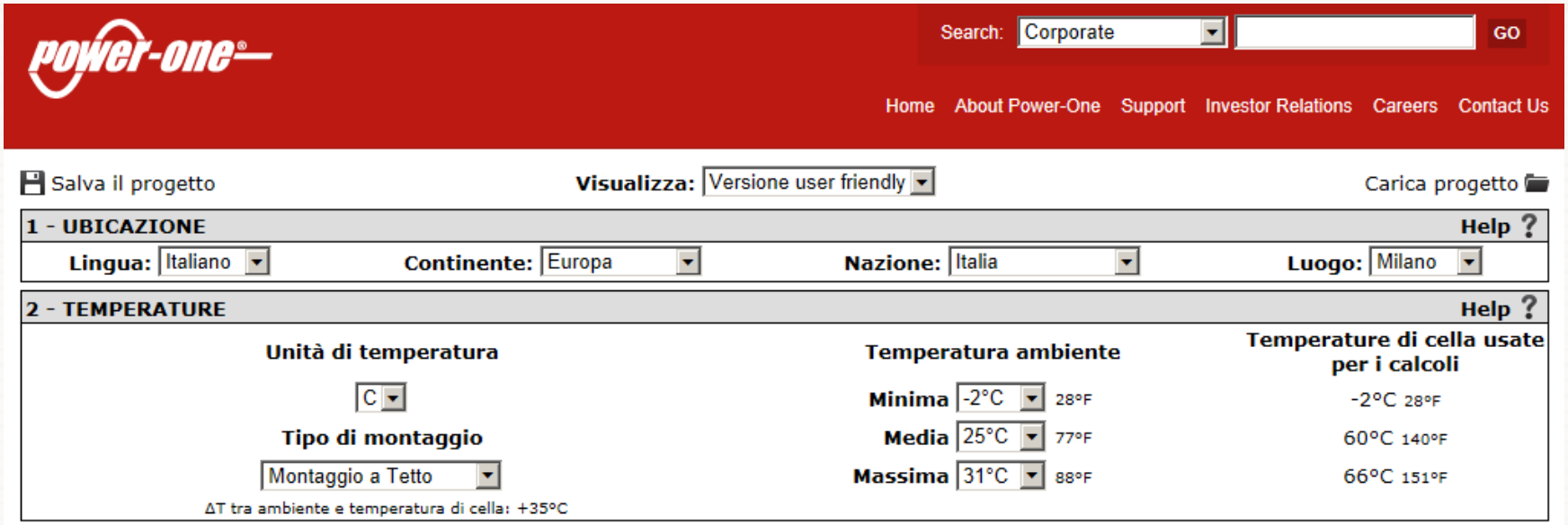
Web String Sizing Tool

Webpage with the application for the configuration of the photovoltaic generator:
http://stringtool.power-one.com/ or directly from the website www.power-one.com.



Web String Sizing Tool

Step-by-step procedure for configuration of the photovoltaic generator with Web String Sizing Tool



View

Standard: in the matrices of the allowed configurations for photovoltaic generator is not provided guidance for the kindness of the configuration

User Friendly: the Web String Sizing Tool, through color mapping, indicates the kindness of the configuration against the characteristics of the inverter.

Step 1 – Location

- *Selection of language and installation location*

Passo 2 – Temperature

- *Selection of mounting type (pole tracker/ground mount/flush on roof)*
- *Setting up minimum ambient temperature (also used as minimum cell temperature to calculate string voltages)*
- *Setting up maximum ambient temperature (maximum cell temperature at which the string voltages are assessed; it is assessed taking into consideration the type of mounting selected)*

Web String Sizing Tool

Step 3 – Selection of PV panels

- *Selection of PV panels brand and model (one model only)*
- *Possibility of change the parameters of the panel when the desired panel is not present in the data base.*
- *Possibility for a request to insert the missing panel in the database*

3 - SELEZIONE PANNELLI FV Help ?

Produttore: Trina Solar

Seleziona Pannello

Modello: TSM-230PC05

Non trovi il modulo che cerchi?
Segnalaci il modulo mancante!

Segnala

Dati del pannello	
Produttore: Trina Solar	Modifica
Modello: TSM-230PC05	
Potenza nominale [W]: 230	**Grounding:** N/D
Tensione Circuito Aperto - Voc [V]: 37	**Corrente Corto Circuito - Isc [A]:** 8.26
Tensione Max Potenza - Vmp [V]: 29.8	**Corrente Max Potenza - Imp [A]:** 7.72
Coeff. temperatura Voc [V/°C]: -0.130	**Coeff. temperatura Isc [mA/°C]:** 4.130
Max.Sys.Volt [V]: 1000	**Coeff. temperatura Pmax [%/°K]:** -0.45
Coeff. temperatura Voc [%/°C]: -0.351	**Coeff. temperatura Isc [%/°C]:** 5.000

Step 4 – Inverter Selection

- *The inverter list is filtered for the installation country selected*
- *The grounding selection is filtered according to the possibilities offered by the inverter*

4 - SELEZIONE INVERTER Help ?

Modello: PVI-12.5-OUTD

Messa a terra: Unground

Dati Inverter	
INGRESSO	**USCITA**
Tensione Min. MPPT [V]: 0,7*Vstart	**Potenza nominale [W]:** 12500
Tensione Max MPPT [V]: 750	**Potenza massima [W]:** 13800
Vstart (default) [V]: 360	**Tensione nominale [V]:** 400
Vstart (range) [V]: 250 - 500	**Numero fasi AC:** 3
Numero MPPT: 2	**Frequenza Nominale [Hz]:** 50

Web String Sizing Tool

Step 5 – Results

- *The tables contain all the possible acceptable configurations for the inverter selected, within a load factor between 40% and 130%.*
- *Are provided many tables as there are possible configurations allowed for the selected inverter with grounding selected (Unground / Grounding Positive / Negative Grounding).*

5 - RISULTATI - Tutte le configurazioni proposte sono compatibili, scegliere la caselle con la configurazione desiderata Help ?

Canali parallelati
Numero di MPPT indipendenti: 1

			Panneli per stringa													
			9	10	11	12	13	14	15	16	17	18	19	20	21	22
MPPT Singolo	Stringhe in parallelo	2					5980 (26)	6440 (28)	6900 (30)	7360 (32)	7820 (34)	8280 (36)	8740 (38)	9200 (40)	9660 (42)	10120 (44)
		3	6210 (27)	6900 (30)	7590 (33)	8280 (36)	8970 (39)	9660 (42)	10350 (45)	11040 (48)	11730 (51)	12420 (54)	13110 (57)	13800 (60)	14490 (63)	15180 (66)
		4	8280 (36)	9200 (40)	10120 (44)	11040 (48)	11960 (52)	12880 (56)	13800 (60)	14720 (64)	15640 (68)	16560 (72)	17480 (76)	18400 (80)		
	Note															

Totale pannelli:	Potenza installata DC:
Fattore di utilizzo:	

Canali indipendenti
Numero di MPPT indipendenti: 2

			Panneli per stringa													
			9	10	11	12	13	14	15	16	17	18	19	20	21	22
MPPT1	Stringhe in parallelo	1	2070 (9)	2300 (10)	2530 (11)	2760 (12)	2990 (13)	3220 (14)	3450 (15)	3680 (16)	3910 (17)	4140 (18)	4370 (19)	4600 (20)	4830 (21)	5060 (22)
		2	4140 (18)	4600 (20)	5060 (22)	5520 (24)	5980 (26)	6440 (28)	6900 (30)	7360 (32)	7820 (34)	8280 (36)	8740 (38)	9200 (40)	9660 (42)	10120 (44)
	Note															

			Panneli per stringa													
			9	10	11	12	13	14	15	16	17	18	19	20	21	22
MPPT2	Stringhe in parallelo	1	2070 (9)	2300 (10)	2530 (11)	2760 (12)	2990 (13)	3220 (14)	3450 (15)	3680 (16)	3910 (17)	4140 (18)	4370 (19)	4600 (20)	4830 (21)	5060 (22)
		2	4140 (18)	4600 (20)	5060 (22)	5520 (24)	5980 (26)	6440 (28)	6900 (30)	7360 (32)	7820 (34)	8280 (36)	8740 (38)	9200 (40)	9660 (42)	10120 (44)
	Note															

Totale pannelli:	Potenza installata DC:
Fattore di utilizzo:	

Web String Sizing Tool

5 - RISULTATI - Tutte le configurazioni proposte sono compatibili, scegliere la caselle con la configurazione desiderata Help ?

Canali parallelati
Numero di MPPT indipendenti: 1

			Pannelli per stringa													
			9	10	11	12	13	14	15	16	17	18	19	20	21	22
MPPT Singolo	Stringhe in parallelo	2					5980 (26)	6440 (28)	6900 (30)	7360 (32)	7820 (34)	8280 (36)	8740 (38)	9200 (40)	9660 (42)	10120 (44)
		3	6210 (27)	6900 (30)	7590 (33)	8280 (36)	8970 (39)	9660 (42)	10350 (45)	11040 (48)	11730 (51)	12420 (54)	13110 (57)	13800 (60)	14490 (63)	15180 (66)
		4	8280 (36)	9200 (40)	10120 (44)	11040 (48)	11960 (52)	12880 (56)	13800 (60)	14720 (64)	15640 (68)	16560 (72)	17480 (76)	18400 (80)		
	Note															

Totale pannelli: | Potenza installata DC:

Fattore di utilizzo:

Canali indipendenti
Numero di MPPT indipendenti: 2

			Pannelli per stringa													
			9	10	11	12	13	14	15	16	17	18	19	20	21	22
MPPT1	Stringhe in parallelo	1	2070 (9)	2300 (10)	2530 (11)	2760 (12)	2990 (13)	3220 (14)	3450 (15)	3680 (16)	3910 (17)	4140 (18)	4370 (19)	4600 (20)	4830 (21)	5060 (22)
		2	4140 (18)	4600 (20)	5060 (22)	5520 (24)	5980 (26)	6440 (28)	6900 (30)	7360 (32)	7820 (34)	8280 (36)	8740 (38)	9200 (40)	9660 (42)	10120 (44)
	Note															

			Pannelli per stringa													
			9	10	11	12	13	14	15	16	17	18	19	20	21	22
MPPT2	Stringhe in parallelo	1	2070 (9)	2300 (10)	2530 (11)	2760 (12)	2990 (13)	3220 (14)	3450 (15)	3680 (16)	3910 (17)	4140 (18)	4370 (19)	4600 (20)	4830 (21)	5060 (22)
		2	4140 (18)	4600 (20)	5060 (22)	5520 (24)	5980 (26)	6440 (28)	6900 (30)	7360 (32)	7820 (34)	8280 (36)	8740 (38)	9200 (40)	9660 (42)	10120 (44)
	Note															

Totale pannelli: | Potenza installata DC:

Fattore di utilizzo:

Step 5 – Results

In the "user friendly" viewing, coloured mapping of cells:

- *Orange cells: The configuration is allowed, but there may be one (or more) of the following conditions:*
  - *Installed power of less than 70% of the Inverter Pdc, max (in the case of string inverters with independent MPPT: installed power on the single input channel to the lower half of the 70% of the inverter PDC, max)*
  - *Installed power greater than the inverter Pdc, max (in the case of string inverters with independent MPPT: installed power on the single channel input exceeding the Pdc, max of the single input channel)*
  - *Need to change the activation voltage.*

- *Yellow cells: The configuration is allowed and the "typical" working point of the photovoltaic generator (Vmp @ Tamb average) does not fall in the near of the nominal input voltage of the inverter (Vin nom.)*

- *Green cells: The configuration is allowed and the "typical" working point of the photovoltaic generator (Vmp @ Tamb average) fall in the near of the nominal input voltage of the inverter (Vin nom.)*

Web String Sizing Tool

power-one® *Changing the Shape of Power*

AURORA®

RIEPILOGO IMPIANTO FOTOVOLTAICO

Luogo
CONTINENTE Europa
NAZIONE Italia
CITTÀ Milano

Temperature (°C)	Amb	Cell
Minima	-2°C	-2°C
Media	25°C	60°C
Massima	31°C	66°C

Montaggio
Montaggio a Tetto

Modello di inverter	PVI-12.5-OUTD
Potenza AC nominale [kW]/ Tensione AC [V]	12500 / 400
Configurazione dei canali	Canali indipendenti (Num. MPPT ind.: 2)
Numero moduli per inverter	68
Potenza DC installata per inverter (STC) [kW]	14280
Note	

Modello fotovoltaico (marca / modello)	Trina Solar / TSM-210PC05
Tecnologia	poly
Potenza nominale [W]	210
Tensione a vuoto Voc [V]	36.4
Corrente di corto circuito Isc [A]	7.86
Tensione MP Vmp [V]	29.2
Corrente MP Imp [A]	7.19
Coefficiente temperatura Voc [V/°C]	-0.127
Coefficiente temperatura Isc [mA/°C]	3.930

	MPPT1	MPPT2	MPPT3	MPPT4	MPPT5	MPPT6
Numero moduli per stringa	18	16	n/a	n/a	n/a	n/a
Numero stringhe in parallelo	2	2	n/a	n/a	n/a	n/a
Numero moduli totale	36	32	n/a	n/a	n/a	n/a
Note			n/a	n/a	n/a	n/a
Potenza STC installata MPPT [kW]	7.56	6.72	n/a	n/a	n/a	n/a
Limite di potenza MPPT [kW]	8	8	n/a	n/a	n/a	n/a
Rapporto di utilizzo MPPT [%]	94.5%	84%	n/a	n/a	n/a	n/a
Tensione Massima sistema moduli [Vdc]	1000	1000	n/a	n/a	n/a	n/a
Tensione Massima ingresso inverter [Vdc]	900	900	n/a	n/a	n/a	n/a
Voc_Max: Tensione a vuoto stringa @-2°C [Vdc]	716.9	637.3	n/a	n/a	n/a	n/a
Voc_Min: Tensione a vuoto stringa @66°C [Vdc]	561.5	499.1	n/a	n/a	n/a	n/a
Tensione di attivazione inverter* [Vdc]	360	360	n/a	n/a	n/a	n/a
Tensione di attivazione inverter minima [Vdc]	250	250	n/a	n/a	n/a	n/a
Vmp_Max: Tensione mp stringa @-2°C [Vdc]	575.2	511.3	n/a	n/a	n/a	n/a
Vmp_Typ: Tensione mp stringa @60°C [Vdc]	461.3	410.1	n/a	n/a	n/a	n/a
Vmp_Min: Tensione mp stringa @66°C [Vdc]	450.3	400.3	n/a	n/a	n/a	n/a
Range per operazione MPPT* [Vdc]**	252 - 750	252 - 750	n/a	n/a	n/a	n/a
Corrente CC generatore FV @66°C [Adc]	16	16	n/a	n/a	n/a	n/a
Corrente CC max inverter [Adc]	22	22	n/a	n/a	n/a	n/a
Corrente MPP generatore FV @66°C [Adc]	14.7	14.7	n/a	n/a	n/a	n/a
Corrente MPP max inverter [Adc]	18	18	n/a	n/a	n/a	n/a
Legenda note						

Termini e condizioni d'uso: questo strumento di progettazione serve a stimare le configurazioni di stringa compatibili con gli inverter fotovoltaici PowerOne della serie Aurora. PowerOne non ha alcuna pretesa circa la loro accuratezza nel prevedere le effettive prestazioni dell'impianto fotovoltaico o dell'inverter o la conformità con i codici e le norme in vigore presso la vostra sede di progetto. Tutte le configurazioni devono essere controllate da un tecnico qualificato per il rispetto dei parametri di funzionamento dell'inverter, e codici elettrici e le norme vigenti nel luogo di installazione. Utilizzando questo strumento, l'utente manleva PowerOne inc. da ogni e qualsiasi danno indiretto derivante dal suo utilizzo.

www.power-one.com

Step 6 – Report

When you locate the appropriate configuration for the plant, select the cells on and create the configuration report that lists the detailed results of the selected configuration.

Product Presentation Stringinverters

Summary- Your Advantages with Power-One Inverters

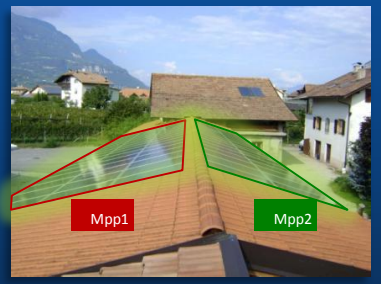
power-one® A MEMBER OF THE ABB GROUP

Why We Win – Advantages with Power-One

✓ High yields and fast amortization

✓ - through optimum performance and flexibility

- High efficiency combined with one of the fastest MPP trackers on the market with an outstanding algorithm for maximum performance
- Two independent MPPT ensure consistently optimum yields even at different module orientations
- Wide input voltage range: provides the user maximum flexibility in the design and planning in the selection of available modules
- Flat efficiency curve over the entire power range provide design flexibility with consistently high efficiency



Why We Win – Advantages with Power-One

- ✓ High yields and fast amortization
- ✓ - through optimum performance and flexibility
- ✓ Simple cost calculation
- ✓ - through all inclusive packages
- ✓ Install more systems in less time
- ✓ - through simple system design, planning and installation
- ✓ „Plug-in & forget“
- ✓ - by the high reliability and quality of AURORA products

Confidential

Why We Win – Advantages Power-One

✓ Simple cost calculation
- due to all-inclusive package

- Standard **RS485 interface** integrated
- Complete **accessories included** (CD, manual, special tools, mounting kit)
- **AURORA Software Communicator** - provides access to all current data

Confidential

Why We Win – Advantages Power-One

High energy yield

High reliability

Quick Installation

Easy use

Flexible in use

CONCLUSION:
Benefit from us, benefit from

- ✓ Our **40 years of experience** as leading provider of innovative highly efficient products for power supply
- ✓ Our success being the **no. 2 inverter manufacturer** worldwide with over **1 million units sold** and a total **installed capacity of more than 11 GW**
- ✓ Our **high level of geographical coverage** and our **compact and widespread sales and post-sales network.**
- ✓ A **complete range of products** and perfectly harmonized components
- ✓ A **full service concept** and wide Academy – including also trainings in other countries

Confidential

Why We Win – Advantages Power-One

Easy to use

Quick Installation

✓ Install more systems in less time
- due to the simple design, planning and installation

- **Standardized concept** for all string inverters > 3kW
- **Two independent MPPTs** for string inverters from 3kW
- Residential products are available including **free of charge portal**
- Complete **accessories including** (CD, manual, special-Tools, Mounting-Kit)

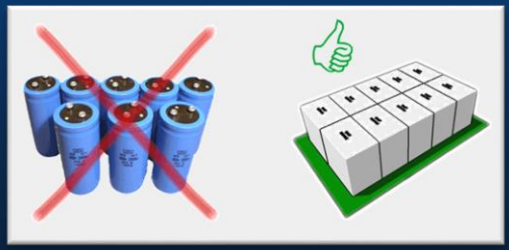
Confidential

power-one® A MEMBER OF THE ABB GROUP

Why We Win – Advantages Power-One

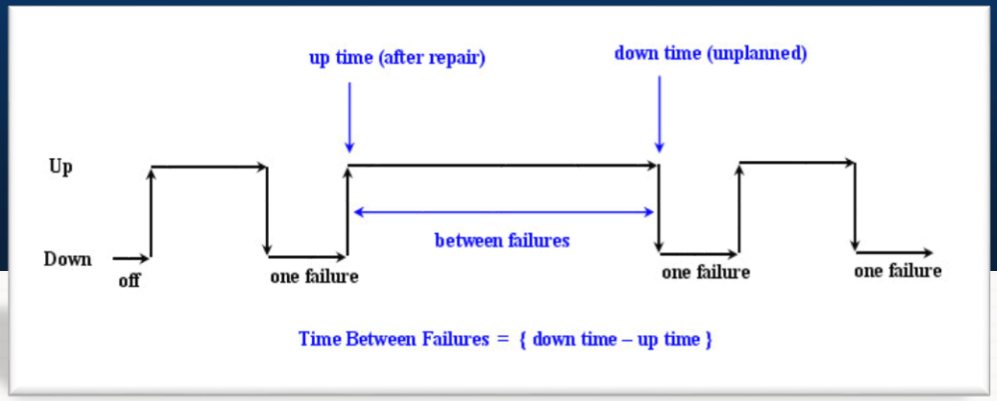
✓ „Plug-in & forget“
- due to high reliability and quality of the AURORA products

- 100% proved quality with a global **TÜV certified** quality system – ISO 9001 & ISO 14001
- **Burn-in tests** prevent early failures
- Standard **protective paintwork** of the boards and the **absence of electrolytic capacitors** ensure a high reliability
- All 3-phase inverters with **10 years of standard warranty**
- All string inverters with optimized **fanless cooling** and with **IP65 class** – thus useable in all environments (also outside unprotected)

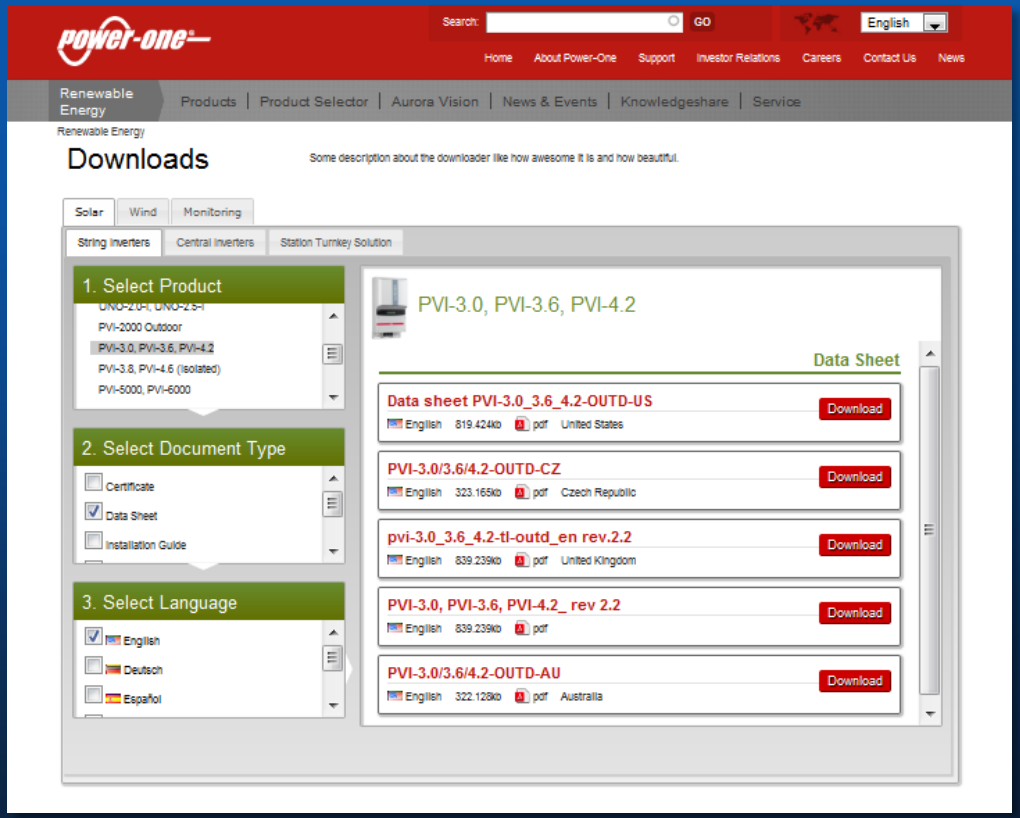


Why We Win – Advantages Power-One

- Global TÜV-registered quality system
  - ISO9001-2000 & ISO-14001
- Accelerated life testing
- Safety & EMC testing (accredited laboratory for UL)
- Mil-hour-217 & Bel-Core **MTBF** calculation



Why We Win – Advantages Power-One



- Download area for documents (data sheets, certificates, manuals etc.)
- Online registration for AURORA Academy
- Online newsletter registration
- Design software
- FAQ Section

Confidential

Why We Win – Advantages Power-One

Online videos

Animations for installers

Any questions ?

power-one®
A MEMBER OF THE ABB GROUP

Thank you for your attention & interest!

Attila Balogh

Senior Sales Engineer
Mobile: +36 20 262 0145
attila.balogh@hu.abb.com | www.abb.hu